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MAY 31 AND JUNE 1 AND 2, 1899.

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LIST OF OFFICERS.

[Elected June 2, 1899.]

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103 State Street, Chicago.

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1890. DE FOREST WILLARD, M.D.
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1898. R. W. LOVETT, M.D.
1899. W. R. TOWNSEND, M.D.
1900. H. M. SHERMAN, M.D.

MEMBERS.

* Original Members.

1892. Blanchard, Wallace, M.D. Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 34 E. Monroe Street, Chicago.

1889. Brackett, E. G., M.D. Assistant Surgeon to the Children's Hospital. 133 Newbury Street, Boston.

*1887. Bradford, E. H., M.D. Visiting Surgeon to the Children's and the Good Samaritan Hospitals; Assistant Professor of Orthopedic Surgery in Harvard Medical School. 133 Newbury Street, Boston.

1889. Burrell, Herbert L., M.D. Visiting Surgeon to the Boston City Hospital; Visiting Surgeon to the Children's Hospital; Assistant Professor of Clinical Surgery, Harvard University. 22 Newbury Street, Boston.

1891. Cook, Ansel G., M.D. Orthopedic Surgeon to the Hartford Hospital. 164 High Street, Hartford, Conn.

1893. Coolidge, Frederic S., M.D. Demonstrator of Surgical Appliances in Rush Medical College; Professor of Orthopedic Surgery, Chicago Post-Graduate Medical College; Attending Orthopedic Surgeon to the St. Luke's and St. Elizabeth's Hospitals; Attending Physician to Children, Presbyterian Hospital. 103 State Street, Chicago.

1895. Dane, John, M.D. Junior Assistant Surgeon to the Children's Hospital; Assistant Surgeon to the West End Infant Hospital. 29 Marlborough Street, Boston.

1897. Davis, Gwilym, G., M.D. Univ. of Penna. and Goettingen, M.R.C.S. Eng. Surgeon to the Philadelphia Orthopedic, Episcopal, and St. Joseph's Hospitals. 255 South Sixteenth Street, Philadelphia, Penna.

*1887. Foster, Charles C., M.D. Orthopedic Surgeon to the Cambridge Hospital; Visiting Physician to the Avon Home for Chil-

dren; Visiting Physician to St. Luke's Home for Children. 5 Riedesel Avenue, Cambridge, Mass.

1899. Galloway, H. P. H., M.D. Surgeon to the Toronto Orthopedic Hospital; Orthopedic Surgeon to the Toronto Western Hospital. 12 East Bloor Street, Toronto, Canada.

*1887. Gibney, V. P., M.D. Clinical Professor of Orthopedic Surgery in the College of Physicians and Surgeons, Medical Department of Columbia University; Surgeon-in-chief to the New York Hospital for Ruptured and Crippled; Orthopedic Surgeon to the Nursery and Children's Hospital and to the Montefiore Home and Hospital, New York. 16 Park Avenue, New York.

1889. Gillette, Arthur J., M.D. Professor of Orthopedic Surgery in the Minnesota State University; Orthopedic Surgeon to St. Luke's, St. Joseph's, Bethesda, City and County Hospitals, and the St. Paul Free Dispensary, and Consulting Orthopedic Surgeon to Asbury Hospital; Surgeon in charge of Minnesota State Hospital for Crippled and Deformed Children. 301 Pleasant Avenue, St. Paul, Minn.

1892. Goldthwait, Joel E., M.D. Orthopedic Surgeon to Carney Hospital; Surgeon to the Good Samaritan Hospital; Assistant Surgeon to the Children's Hospital. 372 Marlborough Street, Boston.

1892. Griffiths, J. D., M.D. Lieutenant-Colonel and Medical Director First Brigade National Guard of Missouri; President of the Association of Military Surgeons of the U. S.; Surgeon to St. Joseph's Hospital, Kansas City; Consulting Surgeon to the German Hospital, Kansas City; Consulting Surgeon to the Kansas City, Fort Scott, and Memphis R. R. Southwest corner Ninth and Grand Avenue, Kansas City, Mo.

1892. Hoadley, A. E., M.D. Professor of Orthopedic Surgery and Surgical Diseases of Joints, Chicago Polyclinic; Professor of Orthopedic Surgery and Surgical Diseases of Joints and Clinical Surgery, College of Physicians and Surgeons; Consulting Orthopedic Surgeon to the Home for Destitute Crippled Children, Chicago. 683 Washington Boulevard, Chicago.

1898. Hoffmann, Phil., M.D. Chief of Orthopedic Clinic, Missouri Medical College; Orthopedic Surgeon to the Bethesda Foundling Asylum and Home. 705 N. Channing Avenue, St. Louis, Mo.

1899. Hopkins, W. Barton, M.D. Visiting Surgeon to the Pennsylvania Hospital. 1904 South Rittenhouse Square, Philadelphia.

1893. Hosmer, A. B., M.D. Orthopedic Surgeon to St. Luke's Hospital. 103 State Street, Chicago.

1893. Hubbard, Le Roy W., M.D. Attending Surgeon for Orthopedic Cases at the Randall's Island Hospitals. 70 West Thirty-fifth Street, New York,

*1887. Judson, A. B., M.D. Orthopedic Surgeon to Out-patient Department of the New York Hospital. 1 Madison Avenue, New York.

1894. Kerr, James, M.D., M.Ch. 1711 H Street, N. W., Washington, D. C.

*1887. Ketch, Samuel, M.D. Clinical Professor of Orthopedic Surgery, Woman's Medical College of the New York Infirmary for Women and Children; Attending Surgeon to the New York Orthopedic Dispensary and Hospital; Attending Orthopedic Surgeon to the Montefiore Home and Hospital for Chronic Invalids. 72 West Fifty-fifth Street, New York.

*1887. Lovett, Robert W., M.D. Surgeon to the Infants' Hospital; Assistant Surgeon to the Children's Hospital; Assistant Surgeon to the Boston City Hospital. 234 Marlborough Street, Boston.

1893. McCurdy, Stewart Le Roy, A.M., M.D. Orthopedic Surgeon to Presbyterian Hospital and East End Dispensary; Professor of Anatomy and Oral Surgery, Pittsburg Dental College; Dean Pittsburg School of Anatomy. 515 Pennsylvania Avenue, Pittsburg, Pa.

1889. McKenzie, B. E., M.D. Associate Lecturer on Surgery in the Ontario Medical College for Women; Orthopedic Surgeon to the Hospital for Sick Children, Toronto. 14 Bloor Street, West, Toronto, Canada.

*1887. Moore, James E., M.D. Professor of Clinical Surgery and Orthopedic Surgery in the University of Minnesota; Orthopedic Surgeon to St. Mary's Hospital; Consulting Surgeon to the Northwestern Hospital for Women and Children. 802 Dayton Building, Minneapolis, Minn.

1889. Myers, T. Halstead, M.D. Attending Orthopedic Surgeon to St. Luke's and New York Foundling Hospitals; Attending Surgeon to New York Orthopedic Dispensary; Consulting Surgeon to St. John's Riverside Hospital, Home of the Annunciation, and New York Lying-in Hospital. 24 West Fiftieth Street, New York.

*1887. Packard, George B., M.D. Professor of Orthopedic Surgery in the Denver University. 1405 Stout Street, Denver.

1899. Painter, Charles F., M.D. Instructor in Orthopedic Surgery at Tufts' Medical School; Assistant in Surgical Pathology at Harvard Medical School; Visiting Surgeon to the House of the Good Samaritan; Assistant Orthopedic Surgeon to the Carney Hospital. 372 Marlborough Street, Boston, Mass.

*1887. Park, Roswell, M.D. Professor of Surgery in the Medical Department of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital and the Buffalo Eye and Ear Infirmary. 510 Delaware Avenue, Buffalo, N. Y.

1890. Phelps, A.M., M.D. Professor of Surgery in the University of Vermont; Professor of Orthopedic Surgery in the University of the City of New York, Medical Department; Professor of Orthopedic Surgery in the Post-Graduate Medical School and Hospital; Visiting Surgeon to the City Hospital, New York; Consulting Surgeon to the Mary Fletcher Hospital, Burlington, Vt.; Surgeon-in-chief to the Orthopedic Department of the Post-Graduate Hospital, New York, 62 East Thirty-fourth Street, New York.

1893. Plimpton, W. O., M.D. Instructor in Orthopedic Surgery, Post-Graduate Medical School and Hospital; Assistant to the Chair of Orthopedic Surgery, University Medical School; Visiting Surgeon to the Post-Graduate Hospital, New York. 40 West Thirty-fourth Street, New York.

*1887. Ridlon, John, M.D. Professor of Orthopedic Surgery in the Northwestern University Medical School and Northwestern University Women's Medical School; Senior Attending Orthopedic Surgeon to St. Luke's Hospital and Michael Reese Hospital; Surgeon-in-charge of the Home for Destitute Crippled Children; Consulting Orthopedic Surgeon to the Mary Thompson Hospital for Women and Children. 103 State Street, Chicago.

*1887. Sayre, Reginald H., M.D. Clinical Professor of Orthopedic Surgery in the University and Bellevue Hospital Medical College; Orthopedic Surgeon to the Out-door Department of Bellevue Hospital; Consulting Surgeon to the Hackensack (N. J.) Hospital; Consulting Surgeon to Hospital for Sick Children, Newark, N. J. 285 Fifth Avenue, New York.

*1887. Schapps, John C., M.D. Pony, Mont.

1889. Scudder, Charles Locke, M.D. Assistant in Clinical and Operative Surgery in Harvard University; Surgeon to the Out-

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*1887. Shaffer, Newton M., M.D. Attending Surgeon-in-chief of the New York Orthopedic Dispensary and Hospital; Consulting Orthopedic Surgeon to St. Luke's and Presbyterian Hospitals; Consulting Physician to the New York Infirmary for Women and Children. 28 East Thirty-eighth Street, New York.

1896. Shands, A. R., M.D. Professor of Orthopedic Surgery in the Medical Department of Columbian University; Assistant Physician-in-charge of General Diseases at Emergency Hospital and Central Dispensary; Surgeon-in-charge of Orthopedic Department Emergency Hospital and Central Dispensary; Attending Physician to Newsboys' Home and Children's Aid Society. 1305 H Street, Washington, D. C.

1889. Sherman, Harry M., A.M., M.D. Orthopedic Surgeon to the Children's Hospital, San Francisco; Clinical Professor of Orthopedic Surgery in the Medical Department of the University of California. 1303 Van Ness Avenue, San Francisco.

*1887. Steele, A. J., M.D. Professor of Orthopedic Surgery in the Medical Department of Washington University; Orthopedic Surgeon to the Martha Parsons Children's Hospital. 2825 Washington Avenue, St. Louis.

*1887. Taylor, Henry Ling, M.D. Clinical Assistant at the Hospital for the Ruptured and Crippled. 60 West Fifty-fifth Street, New York.

1897. Taylor, Robert Tunstall, B.A., M.D. Surgeon-in-charge of the Hospital for the Relief of Crippled and Deformed Children of Baltimore City; Clinical Professor of Orthopedic Surgery of Woman's Medical College; Demonstrator of Orthopedic Surgery in Baltimore Medical College. 2000 Maryland Avenue, Baltimore, Maryland.

1892. Taylor, William J., M.D. Surgeon to St. Agnes' Hospital; Assistant Surgeon to the Orthopedic Hospital and Infirmary for Nervous Diseases. 116 South Eighteenth Street, Philadelphia.

1892. Thorndike, Augustus, M.D. Surgeon to Good Samaritan Hospital; Assistant Surgeon to West End Infant Hospital and Junior Assistant Surgeon to Children's Hospital. 601 Beacon Street, Boston.

1889. Townsend, W. R , M.D. Professor of Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York; Visiting Surgeon to Randall's Island and Bayonne Hospitals; Consulting Orthopedic Surgeon to the French Hospital. 23 West Fifty-third Street, New York.

1889. Weigel, Louis A., M.D. Professor of Orthopedic Surgery in the Medical Department of Niagara University, Buffalo; Orthopedic Surgeon to Rochester City Hospital and Out-patient Department; Consulting Orthopedic Surgeon to Provident Dispensary. 209 East Avenue, Rochester, N. Y.

1890. Whitman, Royal, M.D. Instructor in Orthopedic Surgery and Chief of the Orthopedic Division of the Vanderbilt Clinic in the College of Physicians and Surgeons; Adjunct Professor of Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York. 126 West Fifty-ninth Street, New York.

*1887. Willard, De Forest, M.D. Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; Consulting Surgeon to the White Cripples' Home, the Colored Cripples' Home, and the Home for Incurables, Philadelphia; Consulting Surgeon to the New Jersey State School for Feeble-minded Children. 1601 Walnut Street, Philadelphia.

1891. Wilson, H. Augustus, M.D. Clinical Professor of Orthopedic Surgery in the Jefferson Medical College; Professor of General and Orthopedic Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Consulting Orthopedic Surgeon to the Kensington Hospital for Women and to the Philadelphia Lying-in-Charity. 1611 Spruce Street, Philadelphia.

1893. Wirt, William E., M.D. Professor of Orthopedic Surgery in the Medical Department, University of Wooster; Visiting Surgeon to University Hospital; Orthopedic Surgeon to Cleveland Hospital for Women and Children, Cleveland, Ohio. 122 Euclid Avenue, Cleveland, Ohio.

1890. Young, James K., M.D. Professor of Orthopedic Surgery, Philadelphia Polyclinic; Clinical Professor of Orthopedic Surgery in the Woman's Medical College; Assistant Orthopedic Surgeon to the Hospital, University of Pennsylvania; Instructor in Orthopedics in University of Pennsylvania; Surgeon to the Home for Crippled Children; Orthopedic Surgeon, Hospital of the Good Shepherd, Radnor. 222 South Sixteenth Street, Philadelphia.

DECEASED.

HONORARY MEMBERS.

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1889. Henry G. Davis, M.D.

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1891. C. Fayette Taylor, M.D.

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1895. WILLIAM ADAMS, F.R.C.S., Senior Surgeon to the Great Northern Central Hospital and to the National Hospital for the Paralytic and Epileptic; Consulting Surgeon to the National Orthopedic Hospital. 7 London Road, St. John's Wood (N. W.), London, England.

1891. EDMUND ANDREWS, M.D., 65 Randolph Street, Chicago, Illinois.

1893. O. LANNELONGUE, Professeur à la Faculté de Médecine de Paris (Chaire de Chirurgie); Membre de l'Académie de Médecine; Chirurgien de l'Hôpital Trousseau â Paris, et Député au Parlement Français, et Président de l'Association Générale de Médecine de France. 3 Rue François I., Paris.

1897. BENJAMIN LEE, M.D., Secretary of the State Board of Health of Pennsylvania. Crozer Building, 1420 Chestnut St., Philadelphia, Pa.

1890. WILLIAM MACEWEN, M.D., LL.D., Professor of Clinical Surgery and Surgeon to the Glasgow Royal Infirmary; Surgeon to the Royal Hospital for Sick Children. 3 Woodside Crescent, Glasgow, Scotland.

1893. LEOPOLD OLLIER, M.D., Professeur du Clinique Chirurgicale à la Faculté de Médecine de Lyon; Correspondant de l'Institut de France. 3 Quai de la Charité, Lyons.

1889. LEWIS A. SAYRE, M.D., Professor of Orthopedic Surgery in the Bellevue Hospital Medical College; Consulting Surgeon to the Bellevue Hospital, the Charity Hospital, and the Home for Incurables. 285 Fifth Avenue, New York.

CORRESPONDING MEMBERS.

ELECTED

1889. Dr. F. BEELY. Steglitzer Strasse 10, Berlin, Germany.

1892. Dr. M. BILHAUT, Rédactuer en Chef des Annales d'Orthopédie et de Chirurgie pratiques; Chirurgien des enfants de l'Hôpital International. 5 Avenue de l'Opera, Paris, France.

1894. BERNARD E. BRODHURST, F.R.C.S. Eng., Senior Surgeon to the Royal Orthopedic Hospital; Surgeon to the Royal Hospital for Incurables; Consulting Surgeon to the Belgrave Children's Hospital. 20 Grosvenor Street, Grosvenor Square, London, W.

1894. Dr. JULIUS DOLLINGER, ausserordentlich-öffentlicher Professor für Orthopädie an den königl. ungarischen Universität in Buda-Pest, Operateur und dirigirenden Oberarzt der chir. Abtheilung im Spitalls der Barmherzigen Brüder in Buda-Pest; Mitglied des Landessanitätsrathes; Mitglied des Landesunterrichtsrathes; Mitglied mehrer wissenschaftlichen Gesellschaften und Vereine. Buda-Pest (Ungarn), Rerepescher Str. 52.

1890. Dr. A. HOFFA, Privatdozent der Chirurgie an der Universität Würzburg. Sieboldstrasse 10, Würzburg.

1890. ROBERT JONES, F.R.C.S. Edin., Honorary Surgeon, Royal Southern Hospital. 11 Nelson Street, Great George Square, Liverpool, England.

1899. C. B. KEETLEY, F.R.C.S. Eng.; Senior Surgeon to the West London Hospital; Hon. Treasurer British Orthopedic Society. 56 Grosvenor Street, W., London, Eng.

1890. Dr. E. KIRMISSON, Professeur agrégé de la Faculté de Médecine; Chirurgien de l'Hôpital des Enfants Assisté. 27 Quai d'Orsay, Paris, France.

1890. Dr. SIGFRIED LEVY, Superintending Surgeon of the Society for the Relief of Crippled and Mutilated Children, Copenhagen. 135 Gothersgade, Copenhagen, Denmark.

1892. ERNEST MUIRHEAD LITTLE, F.R.C.S. Eng., Surgeon to the National Orthopedic Hospital. 40 Seymour Street, Portman Square, London, England.

1889. Dr. ADOLF LORENZ. IX. Garnisongasse 3 (Garellihoff), Vienna, Austria.

ELECTED

1889. HOWARD MARSH, F.R.C.S. Eng., Senior Assistant Surgeon and Lecturer on Surgery, St. Bartholomew's Hospital; Consulting Surgeon, Hospital for Sick Children, and Alexandra Hospital for Hip Disease. 30 Bruton Street, W., London, England.

1890. EDMUND OWEN, M.B., F.R.C.S., Surgeon to and Joint Lecturer on Surgery at St. Mary's Hospital; Senior Surgeon to the Hospital for Sick Children, Great Ormond Street. 64 Great Cumberland Place, W., London, England.

1892. PIETRO PANZERI, M.D., Direttore di Istitutio dei Rachitici, Milano. Via S. Calimero 31, Milano, Italy.

1892. ROBERT WILLIAM PARKER, M.R.C.S. Eng., Senior Surgeon, East London Hospital for Children; Surgeon, German Hospital, Dalston. 13 Welbeck Street, W., London, England.

1890. PAUL REDARD, M.D., Lauréat de l'Institut; Ancien Chef de Clinique Chirurgicale de la Faculté de Médecine de Paris; Chirurgien du Dispensaire Furtado-Heine. 3 Rue de Turin, Paris, France.

1888. BERNARD ROTH, F.R.C.S. Eng., Orthopedic Surgeon to the Royal Alexandra Children's Hospital, Brighton. 38 Harley Street, Cavendish Square, W., London, England.

1890. NOBLE SMITH, F.R.C.S. Edin., L.R.C.P. Lond., M.R.C.S. Eng., M.D., Surgeon to All Saints' Children's Hospital; Orthopedic Surgeon to British Home for Incurables. 24 Queen Anne Street, Cavendish Square, W., London, England.

1899. ALFRED H. TUBBY, M.S., M.B., Lond., F.R.C.S. Eng.; Surgeon to the Westminster, National Orthopedic and Evelina Hospitals.

1890. W. J. WALSHAM, F.R.C.S. Eng., M.B. and C.M. Aberdeen, Joint Surgeon and Lecturer on Surgery at St. Bartholomew's Hospital; Surgeon to Metropolitan Hospital; Consulting Surgeon to Hospital for Hip Diseases, Sevenoaks, and to the Bromley Cottage Hospital. 77 Harley Street, London, England.

1899. OSCAR VULPIUS, Privatdozent der Chirurgie au der Universitat Heidelberg, Dozent für Orthopädische Chirurgie Dirigirender Arzt der Orthopädische Chirurgischen Heilaustalt in Heidelberg, Luisenstrasse No. 1.

1890. GEORGE ARTHUR WRIGHT, B.A., M.B. Oxon., F.R.C.S., Senior Assistant Surgeon, Royal Infirmary, Manchester; Surgeon to Children's Hospital, Pendlebury and Manchester. 8a St. John Street, Manchester, England.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

ARTICLE I.—NAME.

This Society shall be called the "American Orthopedic Association."

ARTICLE II.—OBJECT.

The purpose of this Association shall be the advancement of orthopedic science and art.

ARTICLE III.—MEMBERSHIP.

Section 1. The members shall be graduates of regular medical schools, shall be in good professional standing, and shall be especially interested in Orthopedic Surgery.

Sec. 2. There shall be three classes of members, viz.: Acting, Corresponding, and Honorary.

Sec. 3. The number of Active Members shall be limited to sixty, and of Corresponding Members to thirty.

Sec. 4. Candidates for membership shall have been engaged in the practice of medicine for at least five years, and shall have given evidence of satisfactory scientific attainments.

ARTICLE IV.—OFFICERS.

The officers shall consist of a President, a First Vice-President, a Second Vice-President, a Secretary, and a Treasurer, all to be elected annually at the last executive session of a regular meeting.

ARTICLE V.—STANDING COMMITTEES.

There shall be a Committee on Membership, consisting of five members, a Committee on Publication, consisting of three members, and an Executive Committee, consisting of the President, the Secretary, and the Treasurer.

ARTICLE VI.—ELECTIONS.

All elections shall be by ballot; for officers a majority shall elect, for members a four-fifths majority.

ARTICLE VII.—MEETINGS.

The meetings of the Association shall be Regular and Special.

ARTICLE VIII.—FEES.

Active members shall pay an initiation fee of twenty-five dollars, and annual dues of fifteen dollars.

ARTICLE IX.—PUBLISHED PROCEEDINGS.

The business proceedings of the Association shall be published annually. The papers and discussions shall be published annually, unless the Association otherwise directs at the close of the regular meeting.

ARTICLE X.—DISCIPLINE.

A three-fourths vote of all members present at a regular meeting shall be necessary for suspension or expulsion of a member.

ARTICLE XI.—THE CONGRESS.

SECTION 1. This Association shall hold membership in and meet with the Congress of American Physicians and Surgeons.

SEC. 2. It shall, at the first annual meeting held after the adjournment of any Congress, elect a member to represent it on the Executive Committee of the Congress for the ensuing three years, and it shall also elect a second member as an alternate.

ARTICLE XII.—QUORUM.

An actual presence of nine active members at any one meeting shall be necessary for the transaction of business.

ARTICLE XIII.—AMENDMENTS.

Alterations to this Constitution may be made at any regular meeting by a four-fifths vote of all the members present; provided that notice

of the proposed changes, signed by two active members, shall have been given to all the active members at least one month previous to final action.

BY-LAWS.

ARTICLE I.—MEMBERSHIP.

SECTION 1. Nominations for membership shall be made in writing, signed by the proposer and seconder, accompanied by evidence as to the fitness of the candidate for fellowship, and shall be placed in the hands of the Secretary at the previous meeting to the time of the regular meeting.

SEC. 2. Candidates for active membership shall, through the Secretary, present a paper to the Association.

SEC. 3. Only those of acknowledged pre-eminence in orthopedic surgery shall be eligible to honorary membership.

SEC. 4. Foreign residents only shall be eligible to corresponding membership.

SEC. 5. All the scientific privileges of the Association shall be accorded to the honorary and corresponding members.

SEC. 6. Membership shall be forfeited when one ceases to take an active interest in the objects of the Association, or is guilty of an unprofessional act or a public misdemeanor. Action in such cases shall be taken according to Article X. of the Constitution.

SEC. 7. An active member absenting himself for three consecutive meetings, or two years in arrears in payment of dues, may be dropped from the rolls.

SEC. 8. All members in attendance at any meeting shall register in a book provided for the purpose.

ARTICLE II.—OFFICERS AND STANDING COMMITTEES.

SECTION 1. The duties of officers and standing committees shall commence after the adjournment of the meeting at which they are elected or appointed, and shall continue until their successors are duly installed.

SEC. 2. The President shall preside at all meetings, shall deliver an annual address, shall appoint a Committee on Membership of five, two of whom shall have served the preceding year, and a Committee on Publication, and shall fill any vacancies that may occur from resignation or otherwise.

Sec. 3. The Vice-President shall act in the absence of the President.

Sec. 4. The Secretary shall give due notice of and keep the minutes of all meetings, shall conduct all correspondence, shall notify candidates of their election to membership, shall send all papers pertaining to candidates for membership to the chairman of the Committee on Membership one month previous to the time of the annual meeting, including their theses, and inform members of their appointment on committees, and shall perform such other duties as are assigned to him by the Association.

Sec. 5. The Treasurer shall collect all moneys due the Association, be the custodian of the same, and pay it out only on warrant signed by the President and Secretary. At the annual meeting he shall make a report of his receipts and expenditures, which, after being duly audited, shall be filed.

Sec. 6. The Membership Committee shall consider the eligibility of all nominees for membership, and shall report its recommendations to the Association.

Sec. 7. The Executive Committee shall make all necessary arrangements for the meetings of the Association, assign the order for scientific work, and report the same to all members as early as practicable before the time of the annual meeting. It shall further manage such necessary affairs of the Association as are not already assigned to others.

Sec. 8. The Publication Committee shall attend to the preparation, publication, and distribution of the annual proceedings of the Association; and shall have discretionary power as to the matter for publication in questionable cases.

ARTICLE III.—ELECTIONS.

Election of members shall be held at the first executive session of a regular meeting, and of officers at the last business session.

ARTICLE IV.—MEETINGS.

Section 1. The regular meetings shall be held annually during the third week in May of each year, or at such other time and at such place as the Association may elect. If no action should be taken in the matter, the Executive Committee shall decide.

Sec. 2. Special meetings may be called by the Executive Committee or by the President at the written request of ten active members.

Sec. 3. Every third year the Association shall convene as a part of the Congress of American Physicians and Surgeons.

ARTICLE V.—DUES.

The yearly dues shall be paid to the Treasurer at the time of registration.

ARTICLE VI.—PUBLISHED PROCEEDINGS.

SECTION 1. The Transactions shall be printed as soon after the adjournment of the regular meeting as possible, and distributed to the members, one copy to each, except to those in arrears on Association dues.

SEC. 2. Additional copies of the Transactions shall be furnished to members at cost, and to the public at a price to be determined by the Publication Committee.

SEC. 3. Authors desiring reprints of their papers will notify the Publication Committee, who shall already have established rates for reprints with the publishers.

SEC. 4. Papers not in the hands of the Secretary within four weeks after adjournment of the meeting shall be omitted from the Transactions on the unanimous vote of the Publication Committee.

ARTICLE VII.—PAPERS AND DISCUSSIONS.

SECTION 1. Papers read before the Association shall be limited to twenty minutes, unless the time be extended by vote. Discussions shall be limited to five-minute speeches. No member shall speak a second time on the same subject if others desire the floor. The author of the paper shall be privileged to close the debate.

SEC. 2. No papers shall be read that have been previously published. Members publishing their papers after they have been presented to the Association shall designate them, "Read before the American Orthopedic Association." Authors desiring their papers illustrated shall furnish the necessary wood-cuts.

SEC. 3. Proofs sent to authors should be returned within a fortnight, otherwise the matter will go to press without the author's corrections. Marked changes from copy, known as "time-work," shall be paid for by the author.

SEC. 4. Transcripts of the discussion shall be furnished the participants for correction, but not for rewriting.

ARTICLE VIII.—EXECUTIVE.

SECTION 1. Two executive sessions shall be held during each regular annual meeting—to wit: at noon of the first day and at noon of the last day. The order of business shall be:

1. Reading of unapproved minutes and records.
2. Reports of officers and committees and action thereon.
3. Unfinished business.
4. Election.
5. New business.

The last act before the adjournment of the last session shall be the reading of unapproved minutes and action thereon. Urgent business may be transacted at any session by unanimous consent.

SEC. 2. The proceedings of the Association shall be in accordance with parliamentary usage.

ARTICLE IX.—AMENDMENTS.

Proposed amendments to the By-laws shall be submitted in writing and signed by two active members. Previous notice of the proposed changes shall be given. A three-fourths affirmative vote of all members present at a regular meeting shall be necessary to ratification.

THE PRESIDENT'S ADDRESS.

By WISNER R. TOWNSEND, M.D.,
NEW YORK.

For the third time in its history, the American Orthopedic Association meets in this city, and it is my pleasure, on behalf of the members resident here and of the profession of Greater New York, to welcome you to this the thirteenth annual meeting.

Many changes have taken place in the character and in the amount of work done since our organization as a national association, and I desire to briefly take up the history of the institutions in Greater New York that have contributed to the advancement of our chosen specialty. Many interesting facts must be omitted on account of lack of time, but your visits to the different clinics and hospitals of the city I trust may be made more interesting by the few data that I shall present.

The first hospital in the United States was opened in New Amsterdam, now New York, December 20, 1658, when the city had a population of only about one thousand, and its establishment was due to a suggestion made by Master Jacob Hendrickszen Varrevanger, surgeon to the Dutch West India Company, who was its first medical officer. Several other hospital buildings were erected between that date and 1736, when the first "Publick Workhouse and House of Correction of the City of New York" was built, on the site of the present City Hall. This building was fifty-six feet long, twenty-four feet wide, two stories high, with a cellar, and a contract for its erection, with John Roomer, called for an expenditure of £80 in money and for fifty gallons of rum, the corporation to be at the charge for liquor at laying the beams and raising the roof. It contained six beds, and this was really the parent of the present Bellevue Hospital, which came into being in 1811, and was originally planned as a place of isolation for persons afflicted with

malignant fever. From that day to this Bellevue has been the principal public hospital of New York City, and in its amphitheatre was held the first public clinic devoted exclusively to orthopedic surgery ever given in this country. The late Dr. Detmold held private clinics in this specialty as early as 1841, and in the *New York Medical Gazette*, January 1, 1851, vol. ii., we find an editorial to the effect that "Dr. Detmold has consented to deliver a course of lectures on orthopedic surgery, a department in which he has long been distinguished, and the importance of which can scarcely be overrated."

The appointment as a Visiting Surgeon to Bellevue Hospital in 1853 of Dr. Lewis Albert Sayre marks the beginning of orthopedic work in that institution, for although a general surgeon even then, he was devoting much of his time to the cure and prevention of deformities, and in the wards were many patients suffering from hip-joint disease, spinal affections, etc.

In 1861 the Bellevue Hospital Medical College was organized and the first Chair of Orthopedic Surgery established. Two clinics each week were held, beginning in October, one in the college building and the other in the large hospital amphitheatre. Many of Dr. Sayre's private patients were there shown to the class, and systematic instruction began in orthopedic work. The braces and instruments used were made by private instrument-makers, and even now Bellevue Hospital has no shop of its own for this purpose. The number of beds devoted to orthopedic work has varied as changes were made in the hospital management, and at the present time there are six in the children's ward, under the control of and presided over by the Professor of Orthopedic Surgery in the University and Bellevue Hospital Medical College.

Although in Bellevue the first public clinics were held, the first institution devoted solely to the specialty was the Hospital of the New York Society for the Relief of the Ruptured and Crippled. It owes its origin to the efforts of one of the greatest philanthropists of this city, the late Dr. James Knight, who, as early as 1842, advocated the formation of such an institution. His efforts at first bore no fruit, but in 1846 the Association for Improving the Condition of the Poor employed physicians to mitigate the evils of those "suffering from torturing ailments and infirmities." Dr. Knight, a visitor

among the poor, realized how inadequate were the means for caring for the ruptured and the crippled. Trusses and braces were most ex pensive, and the medical profession at that time paid but little attention to their application, with the result that the poor were left to suffer if they could not purchase the expensive trusses, which were in most instances unscientifically and unskilfully applied by their makers.

In 1859 printed circulars were sent out which attracted the attention of many gentlemen of means in New York City, who believed that the time had come for the establishment of a separate hospital for the treatment of "hernia or rupture, varicose veins, and various deformities of the body and limbs;" but it was April 15, 1862, before active steps were taken and a meeting held at No. 39 Bible House, which resulted in the organization of the present Society. The original certificate of intention to incorporate bears the date of December 18, 1862, and March 27, 1863, the Society was duly incorporated and the same recorded in the office of the Secretary of State at Albany, April 13, 1863. Its first medical officer was Dr. Knight, who for twenty years prior to this time had practised orthopedic surgery, making hernia and analogous maladies a specialty. From the start the institution received the indorsement of the Association for Improving the Condition of the Poor, and many of the managers were actively engaged in both societies.

The first hospital work was carried out in the house occupied by Dr. Knight, at No. 97 Second Avenue, which was leased for three years and then purchased by the managers. It was furnished with twenty-eight beds for in-patients, and dispensary patients were cared for in a room on the ground-floor. It was opened May 1, 1863. In the conservatory, in the rear of the building, was established the machine-shop, and at first the trusses and braces used were made at a bench at one side, while the doctor's favorite plants were carefully attended to in another part of the room; but as the work grew the one machinist required the assistance of a boy, and so the little conservatory became crowded and the plants gradually had to give way to the needs of the shop. The tools in use were comparatively few and primitive, and part of the work was done outside. There was no lathe, anvil, or forge, and the holes in the steel were punched, not drilled. There was no soft steel used, and as a result the labor

was greater, and in many instances the hard cast-steel was broken during the process of manufacture. The trusses were shaped in the shop and tempered elsewhere, but were covered and finished in the institution's sewing-room.

The first annual report is most interesting when one compares it with the last, or thirty-fifth report, for the year ending September 30, 1898. During the first year there were 50 indoor and 778 outdoor patients; during 1897–'98 the number of new patients was 9274, which was exceeded in 1895–'96, when 10,592 were registered.

Before the end of the first year the indoor department was filled, and during the second year the increase in the number of new patients (about 15 per cent.) was almost exclusively in the outdoor department. The necessity for such an institution had thus been clearly shown, and during the early years the proportion of hernia patients to the total number was greater than it is to-day; in fact, had it not been for the sufferings of those afflicted with rupture, the establishment of this most worthy charity might have been delayed many years.

In 1869 an assistant resident physician and surgeon was appointed, and a visiting physician and surgeon, whose duty it was to visit the patients at their homes if they were unable to come to the hospital. This position was abolished in 1872.

In 1867 a plot of ground 125 x 100, at the northwest corner of Lexington Avenue and Forty-second Street was purchased, and the new building erected on this site was ready for occupancy in May, 1870. It contained two large wards, one for girls and one for boys, with a capacity for two hundred patients, a dispensary in the basement, and in the cellar a machine-shop. The top floor was a playroom, so constructed as to its roof that it was "open in summer and closed in winter, open to the sun on all sides, and yet shaded from overhead." Advantage was thus taken of giving the patients air and sun-baths—a distinct advance at that time in hospital construction. All the earlier reports of the resident surgeon urged the establishment of a country branch for the chronic patients, and although not in the country the new site was at that time in a portion of the city but little built up. The machine-shop in the basement was a distinct advance upon the one in Second Avenue, yet

very crude as compared with the one now in use in the elegant buildings constructed last year. There was no steam power, and none of the modern tools. Each workman had his bench supplied with files, hammers, and bench-shears, two small cast-iron blocks for bending the steel, and small dies, and for polishing purposes there was a grindstone run by hand-power. In 1871 the shop was moved, an anvil bought, and steam power introduced.

During all this time the dispensary service was increasing, and from time to time new assistants were added to both the outdoor and indoor service as the work developed. In 1872 an instructor in gymnastics was appointed, and this really marks the beginning of the hospital's work in the systematic exercise of patients with lateral curvature and in making use of massage as a remedial measure. In that year a consulting ophthalmic and aural surgeon, a dental surgeon and four consulting physicians were appointed. From that date each year saw additions made to the consulting and active staff until now patients have at their disposal the service of experts in every specialty of medicine that may be needed. A pathologist was first appointed in 1874, and in 1880 we find among the consultants a "mental physiologist," but as this position was held by the late Dr. Séguin we must believe that there was some good reason for the title, although it was changed a year later to "neurologist." The title of the chief medical officer of the institution was changed in 1878 from Resident Physician and Surgeon to Surgeon-in-Chief, and has so remained to the present day.

On October 24, 1887, the founder of the institution, and for twenty-four years its chief executive, entered into rest. No one can read the many annual reports made by Dr. Knight without being fully impressed by his philanthropy and his sincere and devout Christianity. I may be allowed here to quote one paragraph from the resolutions passed by the Board of Managers on October 27, 1887: "His aim in the work of the institution has been to treat the poor and afflicted in such a manner as to accomplish the greatest good with the least possible pain, and the action of this hospital, under his guidance, has been not less one of professional treatment than of constant Christian benevolence."

In the year 1888, owing to a partial destruction of the building by fire, advantage was taken in rebuilding to add another story and

to provide a roof-garden in addition to the play-room. New sanitary plumbing was introduced, an operating-room added, and the dispensary moved to the first floor on the Lexington Avenue side, in the quarters formerly occupied by the Surgeon-in-Chief. The shop was placed beneath the dispensary and the hospital staff increased by the addition of an attending surgeon to the hernia department, thus dividing the hernia from the orthopedic work.

Up to this time very few operations had been performed in the hospital, and these were mostly tenotomies, and of necessity were done in the wards. The first excision of the hip was done in the dispensary, as the operating-room had not yet been completed. With the completion of the latter the surgical work of the institution received a distinct impetus in both orthopedic and hernia departments. Until then the operation for the radical cure of hernia in children had practically never been performed, and the splendid work of this department during the last ten years has done much to establish the value of the operation in the case of patients that cannot be cured by the wearing of a truss.

The work of the hospital has grown year by year, and the demand for increased space induced the managers two years ago to erect the finest building devoted to orthopedic work in this country. A lengthy description is not necessary, but it will suffice to say that it is fully equipped with all requirements for modern scientific work. The out-patient department, besides ample waiting and examination-rooms, contains a fine modern machine-shop, a large well-equipped sewing-room, an ample gymnasium, room for electrical work, two large rooms for the application of plaster-of-Paris, an improved X-ray apparatus and photography rooms, and a modern aseptic operating-room. The in-patient department has five light and roomy wards and isolating quarters in case of contagious diseases. The facilities for surgical work are unsurpassed, separate operating-rooms being provided for the "clean" and the "pus" cases. The latest and most modern sterilizing appliances are at hand, and nothing that money or science can suggest has been omitted to make the building the best of its kind. A pathological and bacteriological laboratory is being equipped, and the large amount of material in the wards will thus be fully utilized for scientific purposes.

The origin of the New York Orthopedic Dispensary is equally

interesting, and is closely associated with the work of the late Dr. C. F. Taylor, who, in 1866, established a private sanitarium at 1303 Broadway, next the site of the present Herald Square Theatre. In his new quarters he began the work of having his braces made at a shop of his own, built in the yard in the rear of his residence. This building was completely equipped with the best tools in existence at that time. About the year 1870 steam power was added, and then a milling machine and lathe for turning.

Like all other surgeons, Dr. Taylor had many patients unable to pay for professional services, and, of course, also unable to pay for costly apparatus, for in those days the expense of making braces was greater than it is to day, with steam and electric power, improved machinery, and lessened cost of materials. To further extend the charitable work and to more fully carry out his mechanical ideas, the New York Orthopedic Dispensary was organized, and opened during the first week of October, 1866. It was incorporated May 1, 1868, and the first meeting of the Board of Trustees was held December 10th. The dispensary occupied two rooms on the second floor of 1299 Broadway, adjoining Dr. Taylor's residence. Between October and May 75 patients applied for treatment, and 67 of them were under treatment on the latter date. Of this number there were 57 cases of angular curvatures of the spine, 4 lateral curvatures of the spine, 6 cases of hip-joint disease, 2 of club-feet, 1 of knock-knee, and 1 of bow-legs. We note that in one of the cases of club-foot the patient was cured by an operation and appropriate after-treatment, but all the other patients were treated by mechanical appliances.

Even in this preliminary report the need for a hospital for such patients was recognized, for it is stated that "Gifts of beds for St. Luke's Hospital would be benefactions most acceptable to the Dispensary," and that this hospital even at that time cared for orthopedic cases is shown by the statement, "My connection with St. Luke's as Consulting Orthopedic Surgeon secures a uniformity of treatment in both institutions and enables patients to continue attendance at the Dispensary after leaving the hospital, thus securing the good begun at that excellent institution."

That the educational side was not to be neglected, and that practical use should be made of the clinical material is shown by Article

I. of the Constitution and By-laws, published in the first annual report, in 1869, as follows: "This Dispensary is organized for the purpose of furnishing treatment to the poor, with special reference to the Diseases and Deformities of the Spine and Hip-joint and other of the more serious diseases of the bones and joints requiring surgical and mechanical treatment, and for giving instruction in the same." During each winter, for many years, under the auspices of the Board of Trustees, a course of lectures illustrated by clinical cases has been given in the institution, to which all members of the medical profession are invited.

The second annual report made a strong appeal for the establishment of a hospital, as the fact was recognized that long-continued and mechanical treatment was often impossible among those applying, because they were too ignorant, too indolent, or too poor to care for the apparatus given them, and for the reason that many patients were too sick to attend at a dispensary, yet could easily be cared for and cured in a hospital; but it was not until May, 1873, that the hospital was added, and in the sixth annual report the name of the institution became the New York Orthopedic Dispensary and Hospital. The erection of the new building at No. 126 East Fifty-ninth Street, was for the purpose of amplifying the mechanical side of orthopedic work and to promulgate the new ideas of traction in the treatment of hip-joint disease.

The new hospital contained twenty-four beds for in-patients, an ample dispensary and a complete workshop for the construction of braces. The work grew steadily, and in 1889 a new building was added, which doubled the facilities. In 1891 still another building was utilized, giving increased space in the wards and permitting of seventy-five patients being comfortably cared for. A modern operating-room was added, the shop and other portions of the building modernized, and to-day it is fully equipped for carrying on the work. This institution was among the first to put in an X-ray apparatus and to make practical use of the same in orthopedic work.

After the year 1870 many other hospitals, dispensaries, and clinics opened their doors for orthopedic work. The specialty was established on a firm footing, and the necessity and value of the work was fully recognized. I shall refer briefly to these institutions in the order of the date at which they began to encourage this special branch.

In 1873 a visiting orthopedic surgeon was appointed to St. Luke's Hospital and was given control of four-fifths of the beds of the children's ward, about thirty in all. The mechanical work needed, by special arrangement, was done at the new orthopedic dispensary shop. Although the appointment dates from 1873, the orthopedic work was actually begun a year earlier, being inaugurated for the purpose of demonstrating the value of the mechanical methods then in use for the treatment of hip-joint disease. This service has been continued to the present day, and in the new St. Luke's Hospital twenty-four beds are allotted to the orthopedic work. In 1874 the University of the City of New York appointed a professor of orthopedic surgery in its post-graduate course, and clinics were held both in the medical college and in the department of the outdoor poor. These have been continued since that date. In 1875 the Women's Medical College of the New York Infirmary for Women and Children appointed a lecturer on orthopedic surgery, and regular clinics were established, which are still continued. In 1878 the New York Hospital opened an out-patient orthopedic department, and still maintains it. Clinics are held twice a week, and if necessary patients can be transferred to the hospital. In 1882 the New York Polyclinic and the Post-Graduate Medical School each established teaching Chairs for the specialty and began holding regular clinics. To-day both of these institutions have wards for the cure of in-patients in addition to their dispensary service. At the New York Polyclinic most of the fifteen children's beds are occupied by orthopedic patients who are freely used for clinical teaching, and the dispensary receives patients two days each week. At the Post-Graduate Hospital, in the old building, was a ward containing sixteen beds, and in the new this number has been increased to thirty. The latter was opened in 1892, and the dispensary service was then increased to four clinics a week. In 1898 a machine-shop was added, and now this institution is fully enabled to carry on the work.

Many other institutions, while not establishing separate wards, have recognized the specialty by appointing consulting orthopedic surgeons—the New York Infant Asylum in 1884, the Foundling Asylum in 1885, the Nursery and Child's Hospital in 1885, the Presbyterian Hospital in 1892, and the French Hospital in 1894. In 1893 a home for crippled children was founded, the House of

Annunciation for Crippled and Incurable Children, and all its orthopedic ward is attended to by a visiting orthopedic surgeon.

In 1894 the College of Physicians and Surgeons, the Medical Department of Columbia University, established clinics and began the teaching of orthopedic surgery by clinical lectures and practical demonstrations, but its surgical clinic had for many years prior to this cared for orthopedic patients, just as has been done in the out-patient department of Roosevelt Hospital since 1887, by having one member of the staff treat all the dislocations, fractures, and deformities, including joint diseases. Other hospitals treat such patients, as St. Mary's Free Hospital for Children, established in 1870; the Laura Franklin, organized in 1886, and the Hospitals of St. John's Guild, and the Babies' Hospital, but the word "orthopedic" does not appear among the titles of their surgeons nor in the reports of their work.

In Brooklyn the first hospital to recognize this specialty was the Brooklyn Hospital, which established an orthopedic department in 1868 and now has two clinics a week, but no shop of its own. St. Mary's, in 1881, had a department of diseases of bones and joints, but it was not until 1888 that an out-patient clinic was started in a building across the street from the hospital. This was open four days a week, and the same room served for the examination and treatment and for the shop. In 1893 the dispensary was moved to the hospital proper, and a well-equipped machine-shop, with steam-power added. From that date the facilities have been increased from time to time, and to-day it supplies braces to other institutions at a very moderate price. In the Seney Hospital the orthopedic cases are cared for in the pediatric department, which was first established in 1892, and the out-clinic started in 1897. The Long Island College Hospital has an orthopedic clinic, opened in 1898, and there is also a home for crippled children—the House of St. Giles the Cripple.

From this brief review of the institutions at which orthopedic work is carried on, it will readily be seen that all classes of the crippled and deformed who have not the means to pay for private treatment can be cared for either at a hospital or a clinic, and, it may be added, more than five hundred beds are devoted to this class of patients. In the out-patient departments of these institutions

during the past year more than fifteen thousand patients applied for treatment.

As has been well said by Dr. Shaffer, in an address on the care of crippled and deformed children, "Nearly all the advance in the use of modern methods in caring for the deformed poor may be traced to New York and to the personal influence of four great men, viz.: Dr. James Knight, the philanthropist and organizer; Dr. Charles Fayette Taylor, the mechanical genius and enthusiastic leader; Dr. Lewis A. Sayre, the impressive teacher and eminent author, and Dr. Henry G. Davis, who revolutionized the treatment of joint and spinal diseases and whose originality and genius made him the father of American orthopedic surgery."

MEMORIAL.

CHARLES FAYETTE TAYLOR.

At the close of the Civil War in this country the medical profession of New York confronted a great opportunity; in reality, it faced a new era. There was to be an enormous growth in commerce, wealth, energy; the professions were to share in this progress.

Among the group of unusual men at that time in the medical profession in New York, when this development was at its greatest, was one to whose memory this Association wishes to pay its tribute. Dr. Charles Fayette Taylor was largely influenced, according to some private notes left by himself, to turn his attention to the branch in which he distinguished himself, by a humanitarian desire to attempt a cure in a child suffering from what was regarded at the time as an incurable disease—caries of the spine. To this effort he enlisted himself with all the energy and ingenuity of a fertile and persistent mind, regarding the supposed impossibility of successful treatment as a challenge for strenuous endeavor.

There was at that time but little pathological knowledge as to the diseases of bone, and Dr. Taylor, working under a sound hypothesis, before pathological data could be collected to demonstrate its value, developed in its details thorough and efficient treatment by the protection of the inflamed and diseased bone. In this work he made use of everything which seemed of service, adding whatever of value the thought of his own original mind could suggest, regardless of tradition. All who are familiar with his work will testify that what he attempted mechanically was done as far as human ingenuity made it possible.

The apparatus used was never an appliance which appeared to, but did not, do what was required, and there was always an object

in his effort. Thoroughness was Dr. Taylor's best quality, and added to this was an extraordinary self-reliance and enthusiasm which attracted patients, and led them to persist during the long years that were necessary for cure under the direction of a masterful intelligence.

The great lack at the time of Dr. Taylor's first efforts was in efficient appliances to meet the surgical indications. Surgeons, as a rule, paid but little attention to such details, leaving these to instrument-makers. It is not strange, therefore, that instruments were furnished to unsuspecting patients that were practically useless in their great inefficacy. Supporting apparatus were worn which did not support, protection apparatus which did not protect, and traction apparatus which did not pull. In short, expensive "make-believes" were used by patients who were ignorant of their uselessness. Dr. Taylor always held firmly to the principle that an apparatus was to fit the patient and not the patient the apparatus, and that each case needed especial and particular attention, success being won only by a thorough mastery of detail.

In many respects Dr. Taylor bore a resemblance in traits to a remarkable contemporary, Hugh Owen Thomas, whom he did not meet and by whom he was uninfluenced, differing, as they also did, in many characteristics. There were in both the same originality of thought, self-reliance, energy, directness, and fertile intelligence. It was to the exercise of these traits that we are indebted so much for the rehabilitation of our branch—orthopedic surgery—from a condition in which it was found thirty years ago, when it was practically a commerce of instrument-makers, an affair of straps and buckles, relieved from the status of a trade chiefly by a belief in the diathesis and struma, which were to be watched. How much humanity were in debt to Dr. Taylor can be seen by an examination of the long record of cases treated by him; the notes of ultimate cures in hundreds of cases of Pott's disease, secured after long years of treatment, showing a success, the difficulty of attainment of which those of our specialty know. We owe him a debt for the foundation of a hospital and dispensary where there has been so much for the profession to learn; for writings of stimulating value; for the device and perfection of appliances original and effective, and for an example of energy and thoroughness which those who knew him felt

and will never forget. A meeting of this Association can never take place without an unconscious tribute to the influence of Charles Fayette Taylor.

Emerson says that young men rarely pay what their youth promises—"They die and dodge the account"—but the promise of our honored associate seems to have been fully met.

E. H. Bradford.

C. Fayette Taylor

THE SPINAL ASSISTANT.[1]

Autobiographical Reminiscences.

By CHARLES FAYETTE TAYLOR, M.D.,
NEW YORK.

I attended a summer course of lectures (1855), and the following winter course at the old New York College, situated on Thirteenth Street between Third and Fourth Avenues, and in the spring I went with Dr. Conant to Burlington, but without the least idea of taking my diploma there. Of course, I had studied hard and accomplished a good deal. I was surprised as the time approached to find that I was spoken of by the professors as one of the prospective graduates. I told them that I had not studied the proper length of time and was deficient in many things. They replied that the time made no difference; it was only intended to secure qualifications; and as to the latter, I was equal to any and better than most in preparation. They acted as if they believed this, for when the hour which had been allotted to me for examination arrived in the forenoon I was asked to wait till afternoon, and some one else was examined in my place. The reason for the change, given to me privately, was that they wished my examination to take place before a larger audience. This compliment was no atonement for practically forcing me into premature graduation, a circumstance which I have never ceased to regret. This was June 6th, I believe, 1856. From Burlington I went to New York, and as soon as possible sailed for

[1] This paper is an extract from some autobiographical reminiscences dictated by Dr. Charles Fayette Taylor to his daughter in 1887, while spending the winter in Martinique, W. I. The reminiscences of which this extract forms a part comprise over a hundred letter-sheet pages, and were written at the earnest request of Dr. Henry Ling Tayor, in order that the early experiences, together with the genesis and development of some of his more important mechanical and therapeutical ideas, might be preserved.

England, leaving Liverpool on my return, on the 29th of November, and reaching New York on the 11th of December of the same year. At New York College Dr. Carnochan, a man of high education and good mind, was professor of surgery, and it was he who told me all I knew about spinal disease until I had acquired it by my own experience. There was nothing in the works on surgery in those days about the disease but the exhibit of a few bones. Carnochan's instructions were: discard apparatus and give the patient plenty of fresh air and exercise. If Roth knew anything about pathology he gave me none of it, but he increased the prejudice against apparatus which Carnochan had implanted. I have made this statement of my lack of clinical opportunities, not to mention other lacks, for a purpose.

I think it was in February or March, 1857, that one evening I was called into my brother's room, for what purpose I knew not; but entering the door, I saw him and his wife, another gentleman and lady, and a little girl in a low chair, all sitting around the grate fire. I stopped at the door and saw something peculiar in the attitude of the child, and I at once said: "That child has disease of the spine; undress her, and you will find it in the lower part of the back." I then learned that my brother had sent for me to see the child with him, she having some peculiar symptoms which he could not make out, but he did not suspect that the spine was involved. Undressing the little girl, a knuckle was found protruding in the usual way in the early stage in Pott's disease, exactly where I had predicted it would be seen. Now I have thought over this circumstance hundreds of times, but never could remember ever having seen a case of spinal disease or having my attention called to the attitudes in connection with the early stages, and never could account for the prompt and accurate diagnosis unless, in point of fact, I had been unconsciously observing attitudes, and, seeing this characteristic case, by a rapid process of exclusion I arrived at the only cause which could produce the result before me. Nevertheless it has always been a mystery to me, and sometimes seems almost like an inspiration coming in time to give direction to my whole course of life.

The case naturally fell to me for treatment. A couple of months later another case of Pott's disease applied, a little girl of about ten

years old, whose name I cannot now recall—the name of the first was Crandell. The second case was farther advanced, though not far advanced, and exhibited some lordosis and decided lateral deviation. In the fall the third case came to me—Charlie C.—a little boy four or five years old, in the very first stage of the disease, which rapidly passed into paralysis of the lower extremities. It is my impression, though I am not quite certain about it, that gastralgia was the prominent symptom in the first, or Cr. case, which caused me to be called in to assist my brother in diagnosis. So that I had during my first year of practice (1857) three cases of disease of the spine in progressive stages with varying symptoms and complications. This is more than many physicians get in their whole lives, and had its effect in ultimately filling me with thoughts on the subject.

I read somewhere about that time that the best spinal instrument was the muscles themselves. The idea is ridiculous, but it chimed in well with all my instruction and prejudices, and I proceeded accordingly with the two patients first named. Two or three months showed unmistakable evidence of losing ground. The Cr. child went home and died that same summer with dysentery. The second case left, and came under the care of Dr. Henry G. Davis, who applied a spinal instrument; the last I heard of her, two years later, she was hopelessly ruined. By the time Charlie C.'s case came into my hands I had seen the folly of expecting the muscles to permanently hold the spinal column in position when there was loss of substance, and I had also begun to appreciate the necessity for protecting the affected vertebræ from motion and weight. So I laid the little fellow down on his back and endeavored to compensate for the loss of exercise in recumbency by gently exercising his upper and lower extremities; but, much to my astonishment, paraplegia supervened, and the case passed out of my hands. He was in various hands afterward, regained the use of his lower extremities, and finally was permanently paralyzed. I do not think I did any of these cases any harm, but I never see Charlie C. carried about, as I sometimes do when in New York, or think of the other cases and of the bitter though instructive experience connected with them, without a quiver of emotion, which is not in the least mitigated by the undoubted fact that, while I was too ignorant to have attempted

the treatment of such cases, I was as competent as anybody at the time. All the cases were in the early stages and, as we now know, might have been cured as certainly, if not as quickly, as a fractured bone. It is a slight consolation, however, to feel that these unsuccessful cases led the way to what had undoubtedly been a great boon to others similarly affected. Among other things the circumstance taught me was never to attempt a case until I felt myself at least hypothetically master of its pathology and treatment.

For six months, perhaps, I had no more cases of Pott's disease, and should not have accepted any if they had applied, though I constantly thought about the subject and read whatever I could find written upon it, which was very little indeed. The second case, while visiting Dr. Davis, returned to the institution for board, giving me an excellent opportunity to see the apparatus. The only impression made by it upon me was admiration for the ingenuity which could devise a means rendering it utterly impossible to effect any mechanical purpose at all. I had already begun to admit the necessity for mechanical means; but, thought I, if this is the best protection for the spine which can be devised, I shall never treat any more cases. This was probably in the spring of 1858. In the fall of the same year, probably late in September or early in October, I was called to the door one day and found there Dr. Marcy, whom I had met only two or three times before, and he surprised me by asking me to see a case of his which he said he could not make out. He explained that it was a child, and he would like me to visit it and tell him what I thought of it, saying that he would see the family, and if agreeable to them the father would call upon me and make the appointment. He did not expect to be present himself at the proposed visit. The next day the father waited on me, and an appointment was made for the same afternoon. The gentleman's name was Gilbert, and he lived west of Sixth Avenue, about Eleventh Street. The mother was expecting me and showed me a little girl about six years old, whom, at my request, she entirely stripped, and she walked about the room before me. This was the first time I had ever done such a thing, and I never omitted it afterward. The usual symptoms—gastralgia, the gliding movements of the legs, throwing back of the head, the stiffening of the shoulders, raising and outward turning of the heels, slight lateral

deviation, the heavy resting against the mother's knee when she approached her; in fact, all the symptoms of Pott's disease which I had observed in greater or less degree in the three preceding cases, and which we now know are characteristic, were combined in this one case; and yet the evidence of loss of substance in the spinal column was so slight that I did not dare to state my convictions till I had assured and reassured myself by making two other visits. There was no projection in the spinal column at all, but I constantly found two lines terminating at a single point, where I concluded there would be a projection, and where events proved there subsequently was. After the second visit I called on Dr. Marcy and told him my impression, which was so strong that I believed the next visit would change to conviction, and said that as the mother continually pressed me for an opinion I preferred not to go again, but he urged me to go and to tell the mother the nature of the trouble if she asked again. I accordingly went. I shall never forget that interview till the latest day of my life. After examining the patient, as before, and finding no change in the symptoms, I thanked her for her kindness and courtesy and, saying that I should not trouble her again, I rose to go; but she detained me, saying: "But you have not told me what is the matter with my child." I then told her as easily as I could the nature of the trouble and again endeavored to get away. But she still detained me and asked for further information of the nature of the disease, which I reluctantly gave her. "How can this be?" she continued. "To all appearances my child is as well as ever, as well as any child. She is not, and she has not been, sick so far as I know." I replied, still insisting that there was a destructive disease in her spinal column. After listening, she said: "Well, of course, it can be cured; it is discovered so early." I had not then learned, and, thank Heaven, I never have learned, to lie to my patients, so I replied that, so far as I knew, there was no cure for it. She sat thoughtful a few minutes, and then asked: "What am I to expect?" And I replied by telling her the progress of the disease in its downward course. She said: "But how long will this be going on?" And I replied: "For many years." "And what will be the result?" she asked. I told her. Then came the hardest question of all: "Do you mean to say," she said, "that my little girl here, who has been always

apparently a healthy child, and now appears to be so, who is still so plump and straight, must go down before my eyes, must suffer, may be confined to the bed with paralysis, with discharging abscesses, down through a series of years, becoming deformed and dwarfed and emaciated, distorted and disfigured, and there is nothing which can be done to prevent, or even to mitigate, such a terrible calamity?" There was but one answer at that time to be made. I made it, and bowed my head and left.

But the impression I had received did not leave me; it has never left me. It burned into my brain as with a red-hot iron. It staid with me and followed me for weeks and weeks; in fact, it never left me until the spinal assistant had been invented. Not that picture alone, but all the afflicted children and all the mothers in the land I seemed to see. By day I read over again what I had previously read; in the evening I walked the streets; from Thirty-eighth Street to South Ferry was a walk frequently taken. I talked with physicians and surgeons on the subject; I visited the shops of the instrument-makers, and I am bound to say that I did not get one idea of any principle of treatment from the whole of them, but I did get a great deal of confusion. Those who admitted the necessity for "support" always began to talk about "vertical support." All the instruments, and they were legion, were contrived with that ostensible idea. But it was idea only, because there was neither fixed point below nor above. Dr. Davis's instrument (before mentioned) was the only one that did have an arrangement to prevent the instrument from sliding down and to actually elevate the arms, but I saw then as well as I have seen since that merely to force the arms up a couple of inches made no appreciable difference in the weight of the upper portion of the body, as the arms slide freely upward for several inches. So I wrestled with the impossible for some time, the problem being to get fixed points which would include both extremities of the spinal column. But as November came its clear cool air seemed to bring more orderly thought. The first real light broke in upon me when I gave hospitality to and finally adopted the term "*protection* to the diseased vertebræ." I think that term in the mind determined the course of thought and its consequences. I remember how the mind hovered around it as one looks at something strange and peculiar, until I

became thoroughly possessed by it. One evening, a few days after having been taken possession of by the word "protection," I had walked to the Astor House and was on my way back again in profound thought, crossing Twenty-first Street on Broadway, and just as I passed into the bright light pouring from an ice-cream saloon (Wagner & Cooper's), the thought of the principle of action of a spinal instrument that would both have fixed points and afford perfect protection to the diseased vertebræ struck me. The sensation was almost awful. I jumped as if I had received a physical blow, and ran all the way home. I had no more doubt at the time that that was the right principle for the treatment of Pott's disease than I have now. The next day I went down town and ordered an instrument, though I had no money and no patient with that disease, and no prospect of any. Dr. Marcy only wished my opinion of the case; there was no suggestion of handing it over to me in any event. Why he thought my opinion at that time worth anything has always been a mystery to me; but he took my diagnosis as conclusive and acted accordingly.

Passing over the trials and tribulations that I had with the instrument-makers, I finally got an instrument approximately as ordered and showed it to several physicians. The first I think was Dr. Willard Parker, who scarcely looked at it, and said he thought Dr. Wood's corset was the best instrument he knew of. I think Dr. George T. Elliott was the next person I took it to; he displayed a languid interest in it, but remembered me and brought me a good case along with the acquaintance of Dr. Van Buren, who was always a good friend to me. Dr. Marion Sims received me very cordially, even warmly, looked at the instrument carefully, appreciated the different points with his mechanical mind, and approved of it almost enthusiastically. I left his presence very much cheered, considering the depressing influence of my interview with Dr. Parker. During my interview with Dr. Sims he spoke to a young man in the room to come and examine the instrument, introducing me to him as Dr. T. Addis Emmet. Within a few months a gentleman appeared in my office and requested me to go and see his little daughter, who had been in bed a year with spinal disease, saying that he came at the suggestion of Dr. Emmet. This gentleman was Mr. Theodore R. Miss Anna R., then a child of three or four years old, whom I

cured after more than ten years' treatment, was my first patient in what is called a "good family." What Dr. Sims was to me you partly know, and will know more before these reminiscences are completed. I distinctly remember, after my chilling reception and dismissal by Dr. Parker, I walked up and down before Dr. Sims' door for fully half an hour before summoning resolution enough to ring the bell, and then not until after I had reminded myself over and over again of the resolve made years before, that whatever seemed clearly best and right to do, that I would do, whatever might be the present hurt or feeling.

Patients came in quite astonishingly, but for the most part of course poor, not able even to pay the cost of the apparatus which I never failed to furnish when necessary. Considering the length of time required to complete a cure in many cases of Pott's disease, it was rare good fortune which brought me a number of those sometimes rapidly recovering cases which have been rare even in later years. I will mention two or three. A Rev. Mr. B. brought me a baby in arms with unmistakable disease of the spine; it was cured and discharged in less than a year. I heard of it ten or fifteen years afterward, and it had remained perfectly well. A Mr. T. brought me a little child two or three years old; the child was cured and discharged in about seven months. The father refused to pay me anything for my services, but he could not take away the satisfaction of having cured his child. Captain T., of Greenport, L. I., came with his wife, carrying their little girl of three and a half years on a pillow. She was quite unable to walk; the very day on which I applied the instrument she insisted upon walking, and continued to do so. She was cured and discharged in about fifteen or eighteen months. I saw her and examined her when she was about nineteen years old, and could trace the point at which loss of substance in the bodies of the vertebræ had begun; but only a practised eye could have discovered it. She was a well-developed, fine young woman, and has since married and is the mother of several children. A boy, seven or eight years old, by the name of Connor, whose mother kept a little shop on Third Avenue, had quite a protrusion of vertebræ in the lumbar region. The farther progress of the destructive process was promptly arrested and he was discharged as cured within a couple of years. I examined him when a young man

of twenty-one or two; found the protruding knuckle of vertebræ as I had first seen it—unmistakable evidence of the former disease—but he was a well-developed young man of full size and perfect health. These, besides many others, had brought experience to aid the primary conviction of the completeness with which the spinal assistant answered all the indications for mechanical support. Beginning with a few cases in the summer of 1859, the cases above named and many others had been treated, or were still under treatment in 1862, when something occurred, an account of which must be set down in this place.

One day there came into my office a gentleman and two young ladies in deep mourning. Though I had seen the gentleman but once before I immediately knew him as the Mr. G. I had previously mentioned, and he introduced the young ladies as his daughters. He began by mentioning the circumstance of my seeing his youngest child four years before, and stated that the child had passed into the care of Dr. Jacob A. Wood, who had applied a corset to her. A few days before they had come to the city for a new corset, which had been made and was then ready. In the meantime his wife had been taken suddenly sick and, after a three days' illness, had died. But before she died, after knowing she could not recover, she had requested that the child should be placed under my care and treatment, saying that everything I had told her had come true to the minutest particular, and she had just heard that I had invented an apparatus and was treating such cases. I found the little girl considerably deformed, but I immediately undertook her treatment, and had the great satisfaction of discharging her cured after three or four years, without any increase of the deformity beyond the point it had reached when she came to me.

There could not be a better illustration of the influence of a definite idea, and a complete expression of that idea, than the effect in determining results of the term "protection" in relation to disease of the spine. The form and action of the apparatus was a mere outgrowth of the fixed idea to protect the affected vertebræ. I distinctly recognized, even at that early day, after my three weeks' travel and travail, that there could be no offspring until there first had been a conception. The conception of protecting the diseased vertebræ brought forth the spinal assistant with the definite form

and with the definite function which it had from the start. As a matter of fact, the apparatus *had to be* just as it was. Neither in this instance nor in any other have I been conscious of any particular labor over mechanical forms and action after I had a clear conception in my own mind of exactly what I wanted to do. It was once reported to me that Dr. Sands, after making some complimentary remark, concluded thus: "But Dr. Taylor is too mechanical." How little did he know about it! I have no doubt but Dr. Sands has spent much more time over mechanical forms than I ever did. My trouble has been to get a clear idea of the thing needed; once a correct view of the principle of treatment, the means followed swiftly, accurately, and without much thought. Thus the spinal assistant necessarily was composed of two uprights, because with no other form is it possible to prevent lateral deviation while exerting antero-posterior force. The first instrument had a horizontal cross-piece at the top, of course; the next one had vertical cross-pieces at each end of the horizontal cross-piece. The second apparatus had the belly-band or apron. All the rest are details developed in the practical working of the machine, mostly to increase the efficacy and the patient's ease and comfort under its action. I cannot at this moment give the exact date of the first use of polished hard pads instead of soft cushions at the fixed points against the body, but I remember it was in Miss S.'s case that I first used polished horn, and that it was about the year 1872 or 1873; and the chest piece followed directly after in the course of a year or so. I can give these dates with a little painstaking with sufficient accuracy.

Another instance of the controlling influence on the mind of a fixed idea relates to the hinges. The apparatus was made with two hinges, allowing the instrument to bend backward but not forward, in order to allow the muscles to act when they wanted to, but to completely protect the affected vertebræ in case the muscles should tire and relax. I very soon found it necessary to arrange stop-screws, and ultimately, as you know, the hinge arrangements became the means of dividing the uprights into sections for convenience of adjustment and alteration. To still further prevent motion at the affected vertebræ the uprights were extended upward and curved over the shoulders, near to the middle portion of the trapezius muscles, and the hip-band, so-called, was changed to the present form,

to still further prevent jostling of the apparatus and motion at the diseased vertebræ, especially in the recumbent position. I suspect that some modification of the combined chest-piece and shoulder-straps, probably in the insertion of a curved piece of steel to raise the cross-strap slightly above, to prevent unpleasant pressure on the sternum, will ultimately supersede the chest-piece. But these are only details relating to efficiency and comfort, but with no modification of the principle as first conceived of as related.

In relation to the spinal assistant, I forgot to say in the proper place that I never heard of but one instance in which it had been claimed that the apparatus did not involve an entirely new principle of treatment for Pott's disease never heretofore attempted. In 1866, I think it was, after an article by me or Dr. Vermilye in the *Medical Record*, Dr. Henry G. Davis, in an article in the same journal, stated that I had copied his instrument without giving him credit. As the correspondence can be seen it is not necessary to repeat its substance here, the primary object of these paragraphs being to refer to that correspondence for the facts of the case. It will be seen that Dr. Davis's instrument as originally made, and which I had seen, was not only different in form, principle, and action from mine, but that he had actually modified his own to resemble mine in some important particulars since mine had been in use. Dr. Davis did not deny a single one of my statements, and his accusation not only fell to the ground, but became ridiculous. Dr. Shrady, editor of the *Record*, sent a letter congratulating me on the completeness of my vindication, though I had no personal acquaintance with him. As this is the only instance that ever came to my knowledge in which I have been accused of copying any other apparatus I mention it here, referring to the full details in the *Record*, though it was of no importance in itself. Except in regard to the principle of the hip-splint, for which I always gave Dr. Davis full credit, I am not aware that any one of my mechanical appliances was so much as suggested by any other apparatus, much less modified or copied from any known apparatus.

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CORRECTION IN LATERAL CURVATURE.

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As lateral curvature is in the main a vice of position and attitude, the treatment is directed chiefly toward the correction of faulty position and attitude. This treatment necessarily depends upon pathological conditions. These vary at the different stages of development and severity of the affection, and these variations may be described as follows:

1. Faulty attitudes with absolute flexibility of the spine and without structural changes of ligaments, cartilage, or bone.

2. A curved position, with flexibility of the spine, except to a limited degree, in positions in which the normal flexibility is checked by slight structural alterations of muscles, ligaments, or cartilage.

3. Curves with limited flexibility of the spine and with structural changes of the ligaments and cartilages.

4. Stiffness of the spine, the curve being fixed by structural changes in the ligaments, cartilages, and bone.

When the individuals have attained their growth, and there is evidence of marked bony change, treatment must necessarily be palliative; but in individuals who have not reached full growth, even if structural changes are present, treatment can be expected to be of service in proportion to the amount of resistance to correction from the shape and structure of the bones.

The treatment of the first and second class would necessarily be largely gymnastic. In the second class the treatment should consist of gymnastics supplemented by the use of measures for

the increase of the flexibility of the spine—that is, the stretching of shortened, contracted ligaments. These methods of treatment have already been fully discussed in previous papers on the subject. In the third class of cases, where resistance to flexibility of the spine exists, owing to firm structural changes, treatment by gymnastics and flexibility exercises will not be sufficient, and for these cases mechanical measures have always been attempted. They have, however, never been thoroughly successful as corrective measures, largely owing to the mechanical difficulty that is encountered. The important problem, therefore, before the orthopedic surgeon is the selection of the best possible means of exerting pressure directly upon the projecting portions of the trunk.

The large number of varieties of corsets that have been devised show the need of some method of treatment of the sort; but the great number of appliances used also indicates the lack of serviceableness and defects of most of them.

It was supposed that the treatment by plaster jackets, suggested by Sayre, would be corrctive; but subsequent experience has shown that although this method is of value in caries of the spine, its value is considerably less in lateral than in antero-posterior curves from caries. The reason of this is manifest from the fact that suspension as applied by Dr. Sayre does not sufficiently correct the twist of the spine seen in lateral curvature.

It may frankly be admitted that the difficulties presented by extreme curves may be insurmountable or may be only partially overcome. If more pressure is required and for a longer time than can be borne by the patient for the correction of the curves of the bone, or for adaptive changes in the muscles and ligaments, manifestly no correction can be made. Conversely, however, experience has taught that if sufficient pressure is applied properly, faulty shapes of bone in growing children can be corrected; in various portions of the skeleton, jaw, and long bones we need this pressure so severe as to be unendurable, provided it be constantly or continuously applied. Bone may be expected to grow straight if it is prevented from growing crooked. The softer the bone and the younger the child the more easily is the change produced.

Removable appliances are necessarily less reliable than fixed ones, owing to the difficulty of thorough readjustment after removal;

and of fixed appliances, plaster-of-Paris corsets are more easily worn and more readily adjusted than anything as yet devised. It is, however, necessary that they should be applied in such a way as to exert and maintain the desired pressure as long as it is considered necessary to maintain corrective pressure.

A plaster jacket, as ordinarily applied for lateral curvature, often slips on wearing, and pressing upon the concavity injures as much as it corrects, even if it corrects at all.

It is manifest that the jacket should be applied with the patient corrected as far as possible, and with the patient kept in the corrected position until the plaster-of-Paris is sufficiently hard to maintain the corrected pressure, and that this correcting pressure should be as great as can be borne without distress, and applied in the best possible directions.

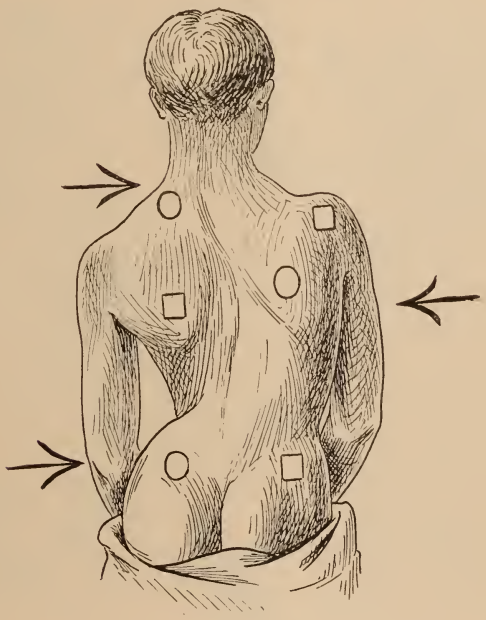
It is not the purpose of this paper to relate details of the experience gained upon this subject. It will be sufficient to mention that the most feasible way of straightening the spine has been found to be by the removal of the superimposed weight by the recumbent position rather than by vertical suspension, as the latter is less easily borne by the patient. It is also true that the use of an anæsthetic, in the correction for lateral curves, has manifest disadvantages and cannot be as frequently applied as is usually necessary for increasing correction in lateral curves.

In cases such as are suited to correction by this method, if the patient is placed upon the back, with or without head and foot traction, the middle line of the trunk can be made straight. Furthermore, if the patient lies with the weight of the trunk supported only upon certain points where upward pressure is applied, the sag of the unsupported portions of the trunk will serve to aid in the correction of the twist of the trunk. This correction of the twist may be aided by pressing upon the prominent portion of the distorted chest and thorax, using for this purpose hand-pressure downward during the application of the plaster upon the front of the patient, while the supporting points on which the patient lies exerts an upward pressure.

In the ordinary curves of lateral curvature the parts requiring correcting pressure in the back are: First, on the projection of the shoulder or adjacent part of the thorax below the scapula on one

side; second, on the opposite side above the scapula or at the base of the neck, and, third, in the lower portion of the trunk in the lumbar region, on the side opposite to the prominent shoulder.

Fig. 1.



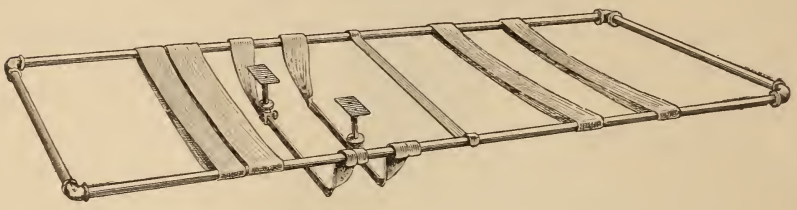
If front-correcting pressure is to be exerted: First, on the thorax at its prominent part on one side; second, on the head of humerus or acromial end of the clavicle; third, projecting anterior-superior spine on the other side.

Pressure in this way can be applied, without discomfort to the patient, if supporting rods bearing small removable plates of aluminum (over which felt is laid) are placed under the recumbent patient's back at the required points, the head and pelvis and thighs being supported by cushions, a table, or by straps stretched across a gas-pipe frame. The plaster bandages are applied as usual.

Downward pressure can be made upon the thorax and shoulder while the plaster is hardening, and when the corset is firm the patient sits up, leaving the adequately padded aluminium plates

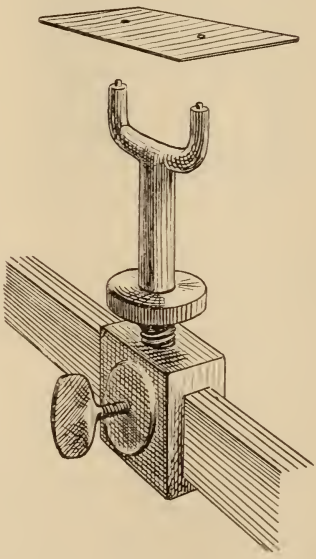
incorporated in the plaster bandage and exerting constant pressure. It is desirable that the plaster-of-Paris cover the shoulder close to the neck on the side of the projecting neck—that is, on the side

FIG. 2.



opposite to the projecting shoulder—or that a strap attached to a steel, be adjusted, exerting pressure at this point. If this is not done the corset will tip when the patient is erect and the points of

FIG. 3.



correcting pressure will be lost, the upper edge of the back of the corset pressing into the concavity of the curvature in the back and the full benefit of the correcting corset lost. The acromial end of the projecting shoulder is to be kept back by a padded strap.

A correcting force should manifestly be applied not beyond the point of easy endurance, and the jackets should be frequently changed. The treatment should be continued as long as it is

Fig. 4.

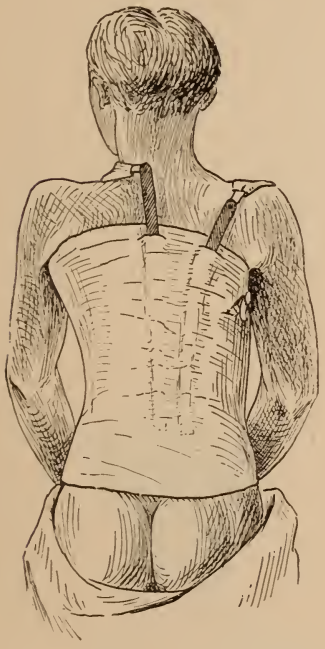
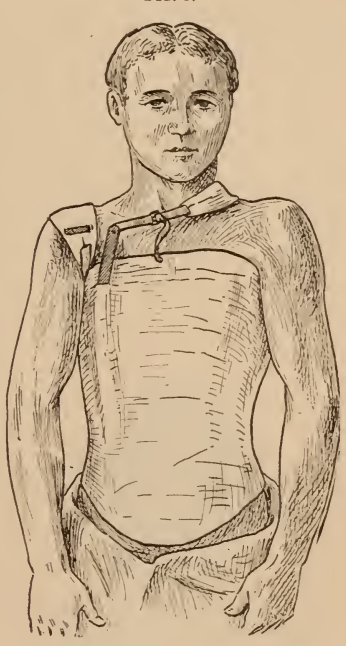


Fig. 5.



possible to obtain correction, after which a removable corset and gymnastic treatment is to be employed.

A few cases will serve as an illustration of this method:

Case I. Girl, sixteen years of age, with low curve; rotation; spine moderately flexible. Child has been weak since a period of rapid growth and unable to carry out systematically any definite exercise. The attempt was made to wear a removable corset, but, owing to the child's condition, this was not successful, and the curve of the back had begun to increase. In view of this the plaster jacket was applied as a matter of trial, although it was felt at the time that possibly it could not be worn; but after two days it was found to be entirely comfortable; the patient much preferred it to any other form of treatment.

Case II. Boy, thirteen years of age. Has worn removable jacket, and attempted gymnastic exercises for over a year, but attention to this has not been satisfactory, owing to the difficulty in making the body carry out systematic treatment. There is a decided curve to the left in the lumbar region, with rotation, and slight curve to the right of the dorsal region above. Suspension or recumbency does not obliterate the deformity.

The jacket was applied and worn with perfect comfort, the boy meanwhile taking part in the sports with children of his own age. The first jacket was worn for a period of nine or ten weeks. The condition of the back shows complete obliteration of the lumbar curve; the upper curve unchanged. In this first jacket no attempt was made toward exerting pressure in the dorsal region of the upper curve.

Fig. 6.

Fig. 7.

Case III. Girl, thirteen years of age, with a resistant curve, which had been noticed for about a year; usual type to the right dorsal convex, with a small left lumbar convex curve, and there was

a permanent rotation of ten degrees. This case presented an unusual degree of inflexibility in a patient of her age. Even by employment of considerable manual force in the recumbent position the curve could not be corrected.

The accompanying figure shows the result in this case after the removal of the second jacket, applied by the method described in this paper. In addition to the change in the condition to be seen in the illustration an improvement in flexibility was noticed; so much so, that with the child recumbent not only did the lateral deviation disappear, but there was improvement in the rotation, which by means of slight manual pressure could be much more diminished.

THE CLASS METHOD OF GYMNASTIC TREATMENT OF LATERAL CURVATURE OF THE SPINE.

By WALTER TRUSLOW, M.D.,
NEW YORK CITY.

This paper is a review of the work and results of the lateral curvature clinic at the New York Hospital for Ruptured and Crippled during the last year and a half. I shall hope to show that although the individual application of exercise, whether heavy or light, is more accurate and effective than group work, the latter is not only a valuable aid in bettering the condition of even the worst cases of scoliosis, but may alone cure the milder forms. The surgeon's aim in the treatment of lateral curvature should be the development of the patient's physique to as high a degree of efficiency as possible. Believing that the employment of such measures as increase the functional activity of the entire motor apparatus—nerve mechanism and muscular mechanism—is the most rational and scientific procedure in the majority of cases, the problem on undertaking the dispensary work was how to apply the exercise treatment to the many patients presenting widely varying conditions.

The symptom of pain is found in comparatively few cases; but in some it is very real and intense, and seems to be of two varieties, etiologically considered—the rheumatoid pain, found more frequently in early cases with purely postural deformity, and due to the continual dragging on poorly nourished and poorly developed muscles; and the neuralgic type, more apt to be found in old, fixed cases and caused by pressure on the intercostal nerves by the infolded and retracted ribs of the concave side. Relief is sought and should be given in either case. A carefully fitted and applied Knight or other brace or plaster-of-Paris jacket will accomplish this in most cases; but the best are burdensome and hamper the

motions of the body—in a word, they limit the actions of the working apparatus. But the majority of patients, whether in private or in dispensary practice, do not come to the orthopedist because of pain. "Her shoulder is getting higher," "the hip is growing out," "her dress don't fit her well," "she stands and sits so crooked." There is a recognized asymmetry, and the surgeon is asked to remove it. Dyspnœa and cardiac embarrassment may be present in late cases, and require careful treatment.

The record of the seventeen months ending May 1, 1899, shows 199 cases examined. The ages have varied from four and a half to twenty-four years, the greater number being from eleven to sixteen years old; 93 per cent. were girls; 4 were colored. Under hereditary conditions, it was noted that in 15 cases a similar deformity had been present in one or more near relatives; in 8, some tubercular history; in 5, cardiac, and in 3, nervous system complications were present in the family, and 1 was a twin, the sister being much stronger than the patient presented. An early history of measles was recorded in 126 cases, of scarlet fever in 48, and of diphtheria in 43. Other forms of previous disease were: Pneumonia, 7; empyema, 3; paralysis, 3; chorea, 17; meningitis, 3, and rickets, 10, although evidences of the last disorder were found to exist in a far greater number of cases. The occupation varied with the age; thus the great majority—141 out of 199—were at school about six hours every day; 9 were factory employés; 6 held clerical positions; 6 were dressmakers; 3, domestics; 2, children's nurses; 1, cooper; 1, devoting his time to violin study, and 30 living at home with no very definite occupation—all leading more or less sedentary lives. Indeed, with but few exceptions, it was found that they were, and had been for some years, less active than those about them. They did not enjoy exercise, and often they were distinctly discouraged in it by their parents. At the time of the onset of the deformity the increase in height had been so marked in thirty-five cases as to lead to the belief that a rapid increase of bone lengths without a corresponding increase of girth measurements—comparative muscle atrophy, if I may so say—was in itself a not infrequent cause of curvature. Certain habits of posture were carefully looked into, and it was found that (1) the carrying of heavy weights, books, or a baby brother or sister on

one side more than the other; (2) the unequal distribution of the weight of the body while standing, and (3) asymmetrical positions at desk or other work—one or all of them were either observed or easily elicited in the great majority of cases. There was a great inability on the part of parents in any way to account for the conditions found. This is to be explained by their ignorance and lack of observance of their children; but a fall or other injury to one side of the body was traceable in twelve cases and astigmatism in two. The effect of an injury in initiating a curvature I would explain by the profound impression made on the child in the necessity to limit movement on that side, partly conscious at first and afterward becoming habitual. Unequal vision—a well-recognized cause of curvature—I believe to exist in many more cases than those noted. Certain less common but easily traceable causes were recorded. These included actual difference of more than one-half inch in length of lower extremities in 8; marked contraction of one side of the chest from excision of one or more ribs, 3; torticollis, 2; partially ankylosed elbow-joint in semi-flexed position from contracting cicatrix, 1; unilateral spastic contraction of pectoralis major, 1; old dislocation of shoulder-joint, 1; talipes varus (girl of fifteen years), 1.

Decided difficulty was experienced in ascertaining the time of onset, hence the duration of the deformity. Previous treatment had been given in 168 cases, and included corsets, with the purpose of "straightening her," in 135 patients; a special brace, 16; plaster-of-Paris jacket, 3; electricity, 1; and some form of gymnastics, 13.

The general examination of the patients showed headaches to be present in 7 cases, localized pain in 39, marked dyspnœa in 1, leucorrhœa in 5, dysmenorrhœa in 4, general rheumatism in 1, also a decided heart lesion in 9 cases, anæmia in 9, and mental deficiency in 3.

The forms of curvature were classified as follows:

Posterior curvature only—*i. e.*, round shoulders, abducted scapulæ, etc.	35
Posterior curve most marked, but with some lateral deviation	17
Single lateral curve to the right	7
Single lateral curve to the left	21

Compound: Right dorsal, left lumbar		
First degree, purely postural, no rotation . . .	32	
Second degree, rotation present	58	
Third degree, rotation fixed	22	
	—	112
Compound: Left dorsal, right lumbar		
First degree, postural and no rotation . . .	1	
Second degree, rotation present	4	
Third degree, rotation fixed	2	
	—	7

That is to say, that of 199 patients examined a little less than half had postural asymmetries, or those which they could by will-power or by suggestion entirely overcome, and a little more than half were afflicted with deformities more or less fixed and beyond the control of their motor apparatus. The treatment followed has aimed, through class work almost exclusively for the first type just mentioned, and through class work supplemented by frequent individual suggestion and exercises in the second type, so to increase the size of the muscles and train the motor apparatus that they will retain or more easily approximate the ideal position.

Patients presented themselves at all times of the year, although it was observed that there was an increase during the early months of the fall of school children, and an increase during the spring of the older working people. This stringing along of the patients, and the fact that no one so far has been refused treatment, were practical difficulties in the class method which it is proposed to obviate in the future by starting a new class every two months and commencing only individual work at once, where that is thought desirable. This would include an extra physical examination of all under treatment just before the new class commenced, to determine (1) who should be discharged as cured; (2) who should be advanced to a class having more difficult work; (3) who should remain where they are, and (4) who, having had a fair trial of perhaps a number of months without improvement, should be dismissed as worthy objects of charitable institutions whose function is to treat chronic patients—clearly not the purpose of an out-door dispensary. The question might be asked, Why receive these cases at all if they are incurable; why not dismiss them at first? The answer is that it is impossible to tell results at the time of exami-

nation; that many of the worst and apparently most hopeless cases have, through their determination and perseverance, made most marked improvement; while others, with but little deformity, but more listless, and handicapped by poor hygienic and dietary surroundings, have shown but little improvement, and in a very few cases have seemed to become worse.

Treatment is given three afternoons a week, from two until five o'clock, in a large room especially set apart for that purpose. There are now four able assistants—young women who are graduates of leading normal schools of gymnastics in the country—who help, two in the class work and two in the individual work exclusively. After examination and shadowgraph record of the case the patient is assigned to the proper class and also to his day of special work, if it is necessary to add this. He is instructed to procure a cheap form of gymnasium slippers and to have loose clothing for the exercise. For the girls, and especially those who are wearing long dresses, the bloomer or gymnasium skirt is strongly recommended, but not insisted upon. This, which it was difficult to get them to start, has now so become the thing that girls will appear in them, after three or four visits, of their own accord.

When the number coming for treatment became too large to be properly handled in one class—I do not like to have more than twenty-five together, and prefer fifteen—division was first made on the basis of variety of curvature, irrespective of age or intelligence. But this was found to be unsatisfactory, because the method of instruction and degree of efficiency possible in a child of eleven years would distinctly hinder the progress of a girl of fifteen years, and it was soon recognized that much of the kind of work which was beneficial for purely postural deformities was equally valuable for partially fixed cases. So division has been made into three classes, about as follows:

Class I. Children and those just past puberty, who are beginning treatment.

Class II. Children who still require more treatment after they have obtained sufficient ability and understanding of their exercise to advance them to work with the older girls, and all older girls or boys who are beginning treatment.

Class III. Made up of all, but especially the cases of greater deformity, who, having acquired a proper degree of general muscular development, are given harder work.

This class, which in its present *personnel* I have the pleasure of demonstrating at this convention,[1] have had a general development which has changed some of them from sickly, anæmic, and deformed patients into healthy and more or less robust boys and girls, who, if they have not eliminated all trace of their curvatures, are at least better able to bear the burdens of life, free from the reasonable fear that their deformity will increase. I do not know of any treatment other than systematic exercise which will accomplish this. This class I consider fit subjects for heavy apparatus work.

An adaptation of Swedish educational gymnastics is the form used. In the system of Ling, as many of you know, the "day's order" is divided into eleven forms of exercise, to include all portions of the body, and so arranged as to vary with consecutive lessons, according to a logical progression of difficulty of performance and requirements of previous training of heart and lungs as well as of the general motor apparatus. This system was chosen because (1) it was believed to be conducive to the greatest accuracy of position, (2) by the use of command more than demonstration of exercise, the conscious assumption of correct positions trains the nervous system clear back to the highest intellectual centres, and (3) in its method of neuromuscular training by means of forced position holding, rather than by continued rhythmic motion, the surgeon is enabled to correct any faulty position at once. Soon after the work was begun an additional practical reason for its use was found in the adoption in the New York public schools of Swedish educational gymnastics, so that those patients who were fortunate enough to be in a school where a little exercise had been crowded into the course were already acquainted with the commands used.

The class work is entirely without apparatus. The bare floor-space and the employment of pure body mechanism—bone and joint leverage—is all that is depended upon for resistance to mus-

[1] N. B.—A demonstration of a class of girls in their teens was given at the Hospital for Ruptured and Crippled.

cular action. It must be remembered that much of the light dumb-bell and Indian-club drill now in vogue tends to develop the arms and forearms out of proportion to the trunk; but trunk development is what we seek, and the weight of the head and of the extremities forms all of the *weight-arm* resistance required when the body is placed in appropriate positions. It should not be inferred, however, that the use of horizontal bars, rings, and of the heavy lifting weights that Teschner advocates are not conducive to good and even more rapid results after fundamental posture concepts have been acquired by the patients. In private practice we can oversee each motion made, but the individual supervision required of the surgeon makes it inapplicable to group work.

The actual make-up of a drill varies day by day, according to the principles of progression above alluded to, but follows strictly the same sequence as to kind of exercises. Thus, after a few quick arm and leg movements to stimulate attention, a formal exercise, to increase all diameters of the thorax by overextension of the upper spine, is given in various ways. After this come forcible arm thrustings, to act upon the muscles with vertebroscapular attachments. Then come balancing exercises, to train the co-ordination of the muscles about the hip, knee, and ankle, and, incidentally, of the lower back. After this the muscles of the lower dorsal and the lumbar regions receive particular attention. Stress is laid upon this variety of exercise, and progression is made as rapidly and accurately as possible. Exercise for the abdominal muscles follow. These are found to constitute a valuable therapeutic agent in overcoming the slouching, postural lordoses so commonly associated with round shoulders and even with kyphoscoliosis. In lateral trunk flexions the danger of increasing the curve mechanically by bending to the wrong side is overcome by noting for each patient at the time of examination which side-bending tended to improve the curve, and by placing her accordingly in one or the other line in the class, where she soon learns to bend to her own side only. A little brisk marching, or a run, and a deep respiratory movement last of all, leaves the patient with a general sense of well-being, and the treatment is over for the day. One class averages from thirty to forty minutes. Allowing five or

ten minutes between classes for the change of clothes, three classes and the individual work are completed in two and one-half hours, and all the patients are treated at each time.

Every exercise and every position thus assumed attains as nearly as possible a typical perfection, but particular stress is laid upon the pose of the back and chest. To maintain a given posture absolutely the entire attention must be concentrated upon the parts so held, especially when this posture is unusual, and anything which diverts the attention weakens the control. One authority has said that the movement of an eyelid affected the posture of the body. These positions, oft assumed, become habitual, because the entire mechanism controlling them has been changed. Possibly the physiologists may one day prove to us that these underlying nerve changes, as well as the muscle changes, are entirely organic, and have an anatomical basis.

Of the 199 patients examined during the time mentioned, 44 have found it impracticable to take the gymnastic treatment, leaving 155 who have had this treatment. Of these the greater number, 115, have had class work only, while 40 have had both class and individual work.

The length of time given to treatment varies; but it is found that the simpler postural cases have required from two to five months, and the severe ones six months to a year, before it is possible to say that they have passed the place where it is reasonable to expect that the deformity will not become worse. It is not thought desirable to keep them longer than a year.

It is difficult to state results accurately, because the patients often simply stop coming without giving the surgeon an opportunity to finally examine them; but the following may be stated of the 155 treated: 30 have been definitely discharged—15 as cured, 14 as much improved, and 1 unimproved and discharged because insubordinate. Fifty-two have discontinued coming to the clinic, and later entries show in their histories 44 cases improving, 4 not yet improved, and of the remaining 4 no entries. Seventy-three of the 155 cases might still be considered as under treatment, though but little more than half that number are regular. Thus out of 82 cases who are no longer under treatment 73 are known to have been cured or improved.

Summary. 1. Varying conditions among curvature cases do not prevent efficient work in groups of fifteen to twenty-five, but a gradation according to age and ability to work is necessary where many are treated.

2. The class method insures the treatment of many more patients than would be possible by individual supervision of exercise.

3. Swedish educational gymnastics are used because well adapted for these three objects: (*a*) To isolate activity in groups of muscles; (*b*) the immediate and effective correction of faulty positions, and (*c*) the development of intelligent and purposeful co-operation of the patient.

4. Nearly all of those who faithfully pursue the treatment show marked improvement.

DISCUSSION.

Dr. Joel E. Goldthwait, of Boston, said that during the past winter he had been using forcible correction in the treatment of quite a large number of patients in both hospital and private practice. He had been impressed with the fact that it did not cure rotary lateral curvature, yet that it had a very definite place as an adjunct to other treatment. A drawing was exhibited, to illustrate the nature of the apparatus employed. His experience, like that of Dr. Brackett, had been that the maximum improvement by forcible correction was reached in a comparatively short time, and that after that little or nothing was accomplished. After this point had been reached the chest expansion lessened. For this reason it seemed to him better, on arriving at this stage, to put on some form of apparatus which could be removed for exercise and then be reapplied, thus preserving the gain already secured and preventing the muscular atrophy. In determining the amount of exercise and the way it should be given, it was most important to study the record of the pulse, taken before exercise and ten minutes after ceasing to exercise.

Dr. John Ridlon, of Chicago, asked Dr. Brackett to say in what position the patient was placed during the application of the plaster-of-Paris jacket—whether on the frame or in some other

position. Dr. Ridlon said that in dispensary work during the past year he had applied a number of jackets on patients who were rested on a modification of the Goldthwait frame, and he had secured excellent results.

Dr. H. A. Wilson, of Philadelphia, said that he had been much impressed with the ability of the surgeon to untwist the spine by the use of his knee as a fulcrum. The method was extremely simple. The patient being seated on a chair with the pelvis flexed, the back to the manipulator, and the hands raised, the surgeon bent the patient laterally over his knee, and after the full amount of flexion had been obtained by rotation of the shoulders in one or the other direction, as might be required, it was possible to obtain a form of correction and untwisting that was exceedingly valuable in developing an increased motion and flexibility of the spine. This had allowed of the subsequent muscular development being carried out much more easily and fully. Certain mechanical appliances would accomplish this equally well, and perhaps better, but they all seemed to terrify the patients much more than the simple method just described.

Dr. Louis A. Weigel, of Rochester, said that a point worthy of special consideration in Dr. Brackett's paper was that the correction was maintained for a long time. By all other methods of treatment whatever change in the form of the spine or trunk took place was maintained for only a comparatively short time. It was well known that a bone subjected to adverse pressure influences all day long could not be corrected permanently by exercise or any form of treatment which covered only a very small part of the twenty-four hours. The point to be considered, therefore, was how much more could be accomplished by this method of continuous corrective pressure.

Dr. B. E. McKenzie, of Toronto, said that the question arose as to how much harm was done to the individual by interfering with the general development of the lungs, the heart, and the muscles. His own experience with the methods advocated by Dr. Brackett had been comparatively limited; he had used all the force that he felt could be safely employed, and had then applied plaster-

of-Paris, but the results had been discouraging, particularly as regards the effect on the general health of the patient. However, he was anxious to adopt as far as possible the principles advocated.

The two methods of individual and class work in gymnastics should be combined. The method which he had published in the Association's TRANSACTIONS a few years ago had not been demonstrated before the members. When the patient was suspended entirely by the neck (not using the hands at all) a girth was thrown around in such a way as to apply its force at the point of greatest lateral curvature. It was attached to a pulley which drew the patient at an angle of about 45 degrees. A very strong horizontal force was applied, the surgeon at the same time using his hands to untwist the rotation. In this manner a very much greater force could be employed, because the body-weight of the patient reinforced his efforts.

In his opinion, the class treatment had very marked advantages. One of the chief of these was the spirit of emulation engendered among those undergoing this treatment. This was a well-established pedagogic principle which should not be ignored. His own observation had been that a good result was obtained only in those cases in which the patient had heartily co-operated with the surgeon. It was, therefore, evident that the teacher should not only thoroughly understand the surgical principles involved, but should possess the necessary tact. He thought as much forcible correction could be applied by the method he had described as by any fixed method.

DR. THOMAS E. SATTERTHWAIT, of New York, was invited to participate in the discussion. He said that in his study of the question of the dislocation of the heart in advanced cases of lateral curvature he had been impressed with the necessity of employing class work if good results were to be obtained. Much more could be accomplished in classes than by individual work, because of the rivalry among the children. Undoubtedly machines would accomplish the desired correction, but a very great deal could be secured by the muscles of the operator, and this seemed to him preferable.

DR. HARRY M. SHERMAN, of San Francisco, remarked that he did not recollect that the final result had been referred to in Dr.

Brackett's paper—*i. e.*, the condition of the patient one year after treatment had been suspended.

Dr. R. H. Sayre, of New York, said that this discussion reminded him of what had been said at the Philadelphia meeting in 1890 in regard to the possibility of twisting spines around their vertical axes. The objection had been made at that time to the apparatus used by Schede and by Buly for this purpose, that the resultant of the two forces they applied to the ribs would tend to increase the angle of the ribs rather than to rotate the spine. Personally, he believed much could be accomplished in the way of correction of a rotary lateral curvature. The patient could not voluntarily correct the deformity any more than he could give active motion to an ankylosed finger-joint until the adhesions had been broken up. In a certain number of cases he had had what seemed to him good results, but had not reported them, because he had been waiting for the ultimate results. In several instances, in which it had seemed to him practically impossible to do very much in the way of rectifying the position of the spine without an anæsthetic, he had, after various exercises and manipulations, anæsthetized the patients and placed them in the prone position. With the heels and head anchored, forcible traction had been made on the spine and correction produced by twisting the spines around and making great pressure on the ribs while an assistant held the pelvis. This procedure had broken up many of the stronger adhesions, and some of the cases had been greatly benefited. While still recumbent they had been placed in a plaster jacket, strong traction still being made. The jacket had been worn until the soreness incident to the twisting had worn off. In one instance he had broken a few ribs, but the patient had not been specially disturbed by this accident, and did not complain of pain after the second day. He had carried out this treatment in one case without an anæsthetic. He recalled the case of a horse-jockey in whom the curvature had been greatly improved by a horse crowding him in the stall and violently squeezing his chest. Sometimes he had resorted to forcible correction at intervals of a month, using a new jacket after each treatment to maintain the improved position. It seemed irrational to expect the patient to hold the spine in posi-

tion without support until it had become sufficiently powerful to do so and the spine had adapted itself to its new condition.

In treating these cases by gymnastics it was very essential to have the patient understand what was to be accomplished by the treatment, and so co-operate with the surgeon in carrying out the principles during the greater part of the twenty four hours by voluntary efforts on his part instead of limiting his exercises to the short time which he passed at the doctor's.

Dr. W. E. Wirt, of Cleveland, said that he made use of gymnastics, mechanical force, and fixation appliances in his lateral curvature cases. He did not approve of having large classes—not more than four or five in each class. If the classes were large the tendency was to neglect the details. He used the Weigel appliance and the suspension plan mentioned by Dr. McKenzie, as well as some others. The corset was applied in the following manner: He corrected the deformity as much as possible by suspension, by posture (the patient lying on two chairs), or by whatever method seemed the best suited to the individual case. Having done this, plaster-of-Paris was applied, and from this mould, after correction, a corset was made which was considerably more corrected than could be obtained by posture alone. A light steel brace was then riveted on the corset. He believed in the twenty-four-hour treatment. If gymnastics were taken in the morning the attention of the child would be sufficiently attracted to maintain the proper position; but at other times, when its attention was liable to be diverted, the corset should be worn. The corset should be removed at night and a sleeping apparatus substituted. He had employed forcible correction, but had endeavored in most instances to secure correction without the use of an anæsthetic. In younger children considerable correction could be obtained without anæsthesia. Quite recently, in a child, he had been able by posturing and manual force to overcorrect the lateral deformity —not the rotation. In a child of three months presenting considerable deformity this overcorrection could be produced, and the wearing of the corset for six months entirely overcome the deformity.

Dr. R. Tunstall Taylor, of Baltimore, asked if Dr. Brackett had used traction while the patient had been on the Goldthwait frame, and how long the jackets were worn. It had been his own system to use daily exercises recommended by Ling, together with the use of the wrench, roller, and other methods. In cases too weak or too listless to hold themselves straight he had used a brace which he had exhibited to the Association in 1897. It had been modelled after the human hand, and took the pelvis as its base of support. An upright extended from a snugly fitting pelvic band up to the convexity. After the child had been thoroughly twisted in the Weigel apparatus adjustments could be made as improvement was obtained. The use of a looking-glass in connection with the exercises and references to photographs aided greatly in properly carrying out the gymnastic exercises.

Dr. Brackett, in closing the discussion, said that the patient lay on the frame. The "pitchforks" were placed under the points where pressure was made. They were tipped by a small aluminium plate, which was well padded. On this the patient lay. The weight of the body was in this way used against the force of rotation. The plaster-of-Paris was applied around the forks, and subsequently the forks were slipped out. The treatment was only regarded as a means, not as an end. He would not regard a case as cured after having had such treatment; the object was to apply continuous force, so as to remould the bone. When this has been accomplished the treatment should be supplemented by whatever means seemed best—a movable brace, with exercises, or exercises without the brace.

With regard to the application of manual force as distinguished from mechanical force, he thought most would agree that the sight of the apparatus was somewhat alarming at first, but experience showed that after one application this fear disappeared. By mechanical pressure the force could be applied much more accurately, not only as regards the region of the spine, but the direction of the force, and the time of application was not limited by the endurance of the operator, and hence could be more prolonged.

Dr. Truslow said that manual work had seemed to him exceedingly valuable, particularly for the reason that the pressure was

not so accurately gauged, but varied constantly and intelligently to suit the present condition. He recalled two cases of paralytic deformity in which gymnastics has been used by him for a short time, and already the effect had been quite remarkable. Small classes were certainly very desirable, but such a method was not applicable to the large clinics, where fifty or more patients had to be treated in an afternoon.

THE CONGENITAL DEFORMITIES OF THE SPINE.

Rhachischisis and Spina Bifida.

By AUGUSTUS THORNDIKE, M.D.,
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Under the terms rhachischisis and spina bifida are included the two principal forms of congenital defects of the spine. Both are characterized by a deficiency of the vertebral arches; they are distinguished by the presence or absence of a well-developed spinal cord. In rhachischisis the cord is rudimentary, always split open, so that the endothelial lining of the central canal of the cord is exposed; this condition may be true of the whole cord-amyelia, or a part of it—partial rhachischisis. In spina bifida the spinal cord has been properly formed and a hernia-like sac of fluid protrudes through the cleft of the vertebral laminæ, which may or may not contain the cord and nerves. Spinæ bifidæ are divided into three groups, according to the position occupied by the fluid—myelocystocele or syringomyelocele, where the fluid distends a portion of the central canal of the cord; meningomyelocele, where it fills the pia or arachnoid spaces and the sac contains fluid, cord, and nerves; and simple meningocele, where the sac consists only of fluid and sac-wall. Spina bifida occulta represents a modification of the ordinary forms in which the hernia-like sac was originally present, but has disappeared.

Rhachischisis and spina bifida have their counterpart in the skull and brain; total rhachischisis, or amyelia, in cranioschisis or anencephalus, partial rhachischisis in derencephalus; myelocystocele, meningomyelocele and spinal meningocele in hydrencephalocele, encephalocele and meningocele. Furthermore, they are frequently associated in the same subject, and are merely defects of

the central nervous system due to the same cause—arrest of development or persistence of early embryonic conditions and to certain later processes, such as the distension of cavities by transuded fluid.

Rhachischisis. Total rhachischisis occurs much more often with anencephalus than without. It is found only among the stillborn

Fig. 1.

Anencephalus with total rhachischisis. Showing the short neck, upturned face, and mane-like growth of hair in the skin of nape and upper back.

or those that live for a short time, and in many instances the child is premature. In the photograph (Fig. 1) the cranial vault is absent, both the exposed base of the skull and the centre of the back is covered by an irregular band of dark red tissue looking like mucous membrane—the area medullo-vasculosa. Outside of

this is a glistening membranous area—the area epithelioidea, merging into the skin ; outside of this junction of skin and membrane are a series of small elevations caused by the ends of the cleft arches sticking up under the skin, and along this line a narrow band of long silky hairs extending half way down the back like a divided mane.

Fig. 2.

Longitudinal section through eight-months' fœtus with total rhachischisis. Showing abnormal curves of spine.

Microscopic examination shows the area medullo-vasculosa to be made up of large sized bloodvessels, nerve-fibres, neuroglia tissue, and a few ganglion cells. The superficial covering is an

epithelial layer of cells—the endothelium of the central canal; from the ventral side the spinal roots pass to the dura and the foramina, and there is a covering of vascular pia mater to the nerve-tissue on its ventral side; there is also a glistening flat membrane on which it lies—the dura.

Fig. 3.

Longitudinal section through anencephalic fœtus. Showing almost normal spinal curves.

The vertebral column frequently presents other deformities beside absence of laminæ and of spines. Before dissection one notes (Fig. 1) a very short back and almost no neck, so that the ears frequently touch the shoulders; the face looks upward instead of forward, producing the frog-like appearance which has been frequently noted. The cause of this abnormal position of the head

and neck will be better understood by referring to Fig. 2, a photograph of a longitudinal section through the body of an eight-months' fœtus with total rhachischisis and anencephalus, with a posterior encephalocele. The upper dorsal and cervical spine take a sudden, sharp antero-convex curve. This curve is present in nearly all cases of total rhachischisis, but the following section (Fig. 3) from a simple anencephalus shows no abnormal curves of the spine, therefore anencephalus alone is insufficient to produce it.

Fig. 4.

Abnormal forward convex curve of dorsal and cervical spine in the skeleton of a case of total cranio-rhachischisis. (Warren Museum.)

The examination of twenty skeletons of rhachischisis in the Warren Medical Museum, Boston, shows that abnormal curvatures, both antero-posterior and lateral, are very common. Here are photographs of some of them.

Fig. 4 presents great deformity of the thorax from extreme antero-posterior curvature of the dorsal and cervical spine. Fig.

5 shows both a lateral curve and a cervical curve like that in Fig. 2. Fig. 6 shows spinal shortening and curvature with a well-developed skull. Fig. 7 shows an attempt to join the upper dorsal arches, and in Fig. 8 the arches are closed in the neck.

FIG. 5.

Anencephalus and total rhachischisis. Slight lateral curvature and abnormal anterior curve of neck. (Warren Museum.)

The spinal cleft is usually symmetrical, and is due to absence of the spinous processes and of both laminæ, and sometimes the transverse processes are not formed. Occasionally the bodies are cleft as well as the arches, so that there is both an anterior and a

posterior split in the spine. The two halves of the spine thus divided separate from each other, to unite below the cleft, as in the photograph (Figs. 9 and 10). Absence of one or more vertebræ is not uncommon ; also segmentation of one or more bodies, or absence of one or more ribs.

Fig. 6.

Rhachischisis with great shortening and abnormal antero-posterior curvatures. Skull well developed. (Warren Museum.)

Partial Rhachischisis. Incomplete or partial rhachischisis means a partial formation of the cord and the interposition of an area medullo-vasculosa, where the cord fails to form. Fig. 11 shows a cervical case. It likewise occurs in the premature or in those that die soon after birth, and is frequently associated with other deformities.

Recklinghausen[1] has figured the appearance of the back ; quite

[1] Virchow's Archives, vol. cv.

different from the appearance in spina bifida. The skin is lacking over a circular area in the centre of the back, which is a typical area medullo-vasculosa, lying as a broad, dark-red circle, surrounded

FIG. 7.

FIG. 8.

Fig. 7.—Anencephalus and total rhachischisis. Showing an attempt to form the upper dorsal arches. (Warren Museum.)

Fig. 8.—Anencephalus and rhachischisis with lateral curvature. The arches of the cervical spine are closed. (Warren Museum.)

by a smooth, glistening membranous ring, which in turn merges into the true skin of the back. The same structures are present, as in complete rhachischisis, but at the upper and lower end of the

FIG. 9.

Cleft of bodies of cervical and seven upper dorsal vertebræ with separation; great shortening and deformity of the thorax and neck. Anterior aspect. (Warren Museum.)

FIG. 10.

Posterior aspect of Fig. 9.

area is slight depressions, the cephalic and caudal poles marking the points where the central canal of the cord begins to be a closed tube above and below.

Fig. 11.

Anencephalus with partial rhachischisis.

Often an accumulation of fluid in the meshes of the pia beneath raises this area medullo-vasculosa upon the top of a quasi cyst, where it lies spread out and exposed to the air. This condition is also figured by Recklinghausen.

Abnormal curves of the vertebral column are present in the skeletons of partial rhachischisis, but I have not seen figured such

extreme deformity as in the cases of total cleft in the Warren Museum. The cleft is said always to involve four or five vertebræ, sometimes more. Any region may be affected, and sometimes there may be clefts in two different parts of the spine.

FIG. 12.

Spina bifida in child of five years. Deficiency of sacral arches. (Warren Museum.)

DIASTEMATOMYELIA. Not infrequently in rhachischisis the area medullo-vasculosa is divided into two symmetrical halves. This is called diastematomyelia, and it is probably due to a failure of the two lateral halves of the undeveloped cord to unite. In spina bifida also the cord is sometimes split in two. This condition is not a reduplication of the cord, for the two halves together hardly equal in size the cord above.

A bony or cartilaginous spur is usually found dividing the spinal cord in two at the point of bifurcation, as if the cord had been split by it. The chief interest in this deformity lies in the fact that a similar condition has been artificially produced in fishes and in frogs by interfering with the development of the embryos in laboratory experiments.

Spina Bifida. Spina bifida was defined by Nicolai Tulpius in 1685 as a congenital malformation in which the vertebral arches are cleft and a hernia-like sac protrudes posteriorly. In rare instances, like the rhachischisics, there may be a celft of the vertebral bodies as well. Fig. 12 shows the sacrum of a child of five with spina bifida. The sac always contains fluid, and on the location of the fluid is based the classification of the three groups into which spina bifida has been divided—syringomyelocele or myelocystocele, meningomyelocele and spinal meningocele.

Myelocystocele. Myelocystocele is fortunately a rare occurrence. It occurs in the lumbar or cervical spine, very rarely elsewhere. Like rhachischisis, it is characterized by considerable deformity of both cord and spine, but the arrest of development probably takes place after the complete formation of the neural canal or canal of the cord, which is distended for a short distance by fluid, so that the cord itself is dilated to form the sac wall. In the report of the spina bifida committee of the Clinical Society of London[1] only two authentic cases of pure syringomyelocele were found. It is recognized at autopsy by the fact that the nerves loose themselves in the sac wall, and also by the complete absence of nerves or bands traversing the cavity of the sac. The following spinal deformities have been said to occur with myelocystocele :

1. Cleft to one side of the median line involving one or two vertebræ.
2. Extensive lateral curvature of the spine.
3. Segmentation, defects, or asymmetry of the vertebræ.
4. Marked kyphosis or lordosis.

Myelocystoceles are usually in the lumbar enlargement, which occupies a large part of the cord during the second month of life.

[1] Transactions of the Clinical Society, vol. xviii.

It is a curious coincidence that the central canal, which has become slit-like and small in the upper part of the cord, remains quite large in the lumbar region almost until birth. It is possible that a little excess of fluid here in early fœtal life may cause the condition. Recklinghausen found a large hernia of abdominal organs —*bauchdarmblasenspalte*—in ten out of eleven cases.

Rare as it is to meet with uncomplicated myelocystocele, it is not so uncommon to find it associated with a collection of fluid outside of the cord in the meshes of the pia or arachnoid, a myelocystomeningocele, as the Germans call it. Recklinghausen speaks of the following varieties of myelocystomeningocele :

1. A cystic cord with a cyst of the pia arachnoid lying on its dorsal side. Such a case was Mr. Clutton's.[1]

2. A cystic cord squeezed up out of the spinal canal by a meningeal cyst beneath it.

3. A rupture of the distended cord into a meningeal cyst; the cord where it is split open exposes the lining of its central canal like the area medullo-vasculosa of rhachischisis, only it is exposed in the interior of the spina bifida sac instead of lying exposed externally to the air.

4. Finally, the distended cord lifted by meningeal fluid may burst externally, leaving a small sinus opening into the central canal, as in the case figured in the Clinical Society's *Transactions;* also in Kirmisson's case.[2]

Myelomeningocele. Myelomeningoceles are hernia-like sacs protruding through the spinal cleft and containing within the sac both nerve-roots and cord unless the deformity be so low that only the cauda equina is involved. The fluid is in the meshes of the pia or arachnoid, and the sac is often multilocular and covered in a large part by membrane.

Myelomeningoceles may be divided into those where the cord is attached to the sac and those where it runs through the cavity without attaching itself; but even in these the nerves or nerve-roots may be attached to the sac wall. It is common in the lower segments of the cord, uncommon in the dorsal, and rare in the cervical spine.

[1] Transactions of the Clinical Society of London, vol. xix.
[2] Kirmisson: Maladies Congenitales Chirurgicales. Paris, 1898.

This photograph (Fig. 13), from a specimen in the Warren Museum, illustrates the first variety when the cord is attached to the dorsal wall of the sac. The attachment may be at a single point or the cord may be fastened for some distance and flattened out. This condition is revealed externally by a deep pucker, as noted by Virchow in 1863. The nerve-roots and the nerves are

Fig. 13.

Section through a myelomeningocele. The lumbar enlargement is attached to the posterior wall of the sac, and has been divided. The nerve-roots are seen running from this part of the posterior sac wall toward the foramina. (Warren Museum.)

separated, owing to this backward displacement, by a considerable distance from their respective spinal foramina, and are at times quite thin and sometimes devoid of axis cylinders. At other times the coat of pia and the connective tissue of the nerve-sheath is œdematous, so that they appear like translucent dark red bands.

This swollen appearance may be seen in both varieties of myelomeningoceles.

The occurrence of motor, sensory, and trophic paralysis may sometimes be explained by this condition ; but this is not the only explanation of their occurrence, for the cord and nerve-roots often undergo compression and softening from the pressure of a tumor complicating the spina bifida.

The outer covering of a myelomeningocele's sac is often membranous except for a small portion around the base, and the shape is more or less irregular, like a tomato, owing to the partitions which divide the cavity ; the presence of the cord or nerves may be inferred from the shadows on looking through the sac with a hydroscope, exactly as one would in examining a hydrocele, using a strong light on the opposite side ; also by applying to all the different points in the wall a small electrode with a mild faradic current. However, clinical differentiation of myelomeningocele from simple meningocele and myelocystocele is often difficult, sometimes impossible, because these tests are not always reliable. Thoma says the sac wall is made up of skin, subcutaneous fat, superficial and deep fascia, dura, and arachnoid ; that is, the fluid is in the meshes of the pia or arachnoid, except at the place where the cord is adherent ; there the dura is wanting.[1] Recklinghausen believes the dura to be absent over the top of the sac, whether the cord be adherent or not. When the sac is membranous the outermost covering is said to consist of a growth of the fibrous layer of the skin devoid of fat and gland tissue.

Simple Meningocele. Simple meningoceles (Fig. 14) are spoken of by some writers as the rarest form of spina bifida ; it has also been called the most common. This may be due to the scarcity of museum specimens, owing to the lower death-rate in this variety, for, as noted above, the clinical differentiation is sometimes lacking. Muscatello[2] found it once out of thirteen cases, and Hildebrand seven times out of thirty cases, but different observers vary a great deal. The committee of the London Clinical Society knew of twenty-seven cases. It is probably not a very rare condition, but is less common than meningomyelocele.

[1] Beringier: Bull. de la Société Anatomique, 1879, p. 796.
[2] Langenbeck's Archives, vol. xlviii.

Bergmann says the cleft is frequently situated to one side of the median line, the pedicle is often very slender, and may even escape

Fig. 14.

Photograph of a simple meningocele sac. The posterior wall has been turned aside, giving a view of the narrow opening into the spinal canal. (Warren Museum.)

through a wide intervertebral space. They are situated generally in the lumbo-sacral or sacral region, are decidedly uncommon in the cervical and lumbar spine, and very rare in the dorsal. Ac-

cording to Thoma the sac is lined with dura throughout and the fluid lies in the subdural space. The cord and nerves may lie free in the sac near the orifice. Fig. 10 is a photograph from a specimen in the Warren Museum, showing the smooth dural lining of the sac, which has been cut open posteriorly. They may be recognized by their uniform globular shape and the absence of shadows on examining with the hygroscope. They are usually covered with skin, occasionally a small area on top is membranous.

Tumors Complicating Spina Bifida. Many cases of spina bifida have been reported complicated by tumors of congenital

Fig. 15.

Cyst of a spina bifida removed by operation. Showing many partitions with nerves running in them. A multilocular myelomeningocele, formerly miscalled cystosarcoma. (Warren Museum.)

origin—cysts, lymphangiomata, angiomata, myomata, lipomata, fibromata, and mixed tumors containing fibrous tissue, fat, muscle, cartilage, and bone, while steatomata, dermoid cysts, and true teratomata have all been described. For the most part these

growths come in the sacral region, where the same influences are at work which predisposes to the growth of congenital sacro-coccygeal cysts and tumors. They are frequently attached to the meninges or lie partly within the spinal canal compressing the cord and roots.

By far the commonest of the tumors is the multilocular cyst, formerly erroneously called cystosarcoma (Fig. 15). It merely represents the dilatation of numerous lymph-spaces in the pia and arachnoid, giving rise to a number of cyst cavities. Simple fibrous growth in the sac wall is not uncommon, and may be considered as an attempt at a natural cure, as the cicatricial contraction of the fibrous tissue produces gradual shrinkage of the sac.

In the so-called spina bifida occulta no cyst or sac projects from the back, but a scar and an abnormal bunch of hair in the median line is the only external sign of the defect. Recklinghausen has shown that in early life or in fœtal life there was a projecting sac which shrivelled away slowly, leaving only a scar or a patch of hair (hypertrichosis) to mark the spot where it had been. The same condition has been noted by Fischer in a man where the scar had been removed by operation in early childhood. Sometimes a soft mass can be felt like a diffuse lipoma beneath the area of hypertrichosis. In a case of Kirmisson's the hypertrichosis was absent, but there was a deep dimple like the umbilicus over the lower part of the sternum and an inch to the right of the median line.

On dissection one finds a cleft of several vertebræ closed in by a thick fibrous membrane which is perforated by a fibro-muscular band connecting an external tumor with a similar growth inside of the spinal canal. In Ribbert's case, in Recklinghausen's, and in Bohnstedt's there was considerable softening and compression of the cord and nerve-roots ; paralysis, atrophy, anæsthesia, and perforating ulcers of the foot, and rectal and vesical incontinence have been attributed to it. Robert Jones, in 1889, cut away the dense fibrous bands pressing on the cord and cured the patient of paralysis.

Spina bifida occulta is often present with club-foot, congenital dislocation of the hip, and other deformities. Scoliosis and abnormal kyphosis and lordosis frequently occur, and I have at present

under observation such a case with a short back and an abnormal lordosis in the mid-dorsal spine under the hairy patch. No satisfactory explanation has been given for the hypertrichosis. The tip of the lumbar cord has been found to extend in spina bifida occulta down into the sacrum sometimes as far as the coccyx instead of stopping in the third lumbar canal.

Virchow asserts that many of the so-called caudal appendages of man are sacral spinæ bifidæ complicated by the growth of a tumor, and are really cases of spina bifida occulta. This is undoubtedly true of most if not all of the fleshy or boneless tails.

Muscatello[1] collected thirty-two cases of spina bifida occulta, of which nine were lumbar, eight lumbo-sacral, six sacral, and two dorsal. Börst[2] divides congenital tumors complicating spina bifida occulta into three classes : 1. Tumors originating from the meninges. 2. Gliomata growing from the cord itself. 3. Mixed tumors combined with spina bifida and masking it. The latter, he says, are the result of the transplantation of foreign tissue in embryonic life. It is the commonest variety. Some forty-eight cases are on record according to him. This foreign tissue may be the result of the growth of some cells from the tissues outside of the spinal canal. Also, it may come from another individual or undeveloped tissue, as in a case of Jones', who removed a third arm from between the scapulæ, and in so doing opened a cleft in the vertebræ and spinal dura. The so-called congenital sacro-coccygeal tumors are said rarely to have any association with spina bifida occulta.

Etiology. The cause of the deformity is unknown. Many theories have been advanced to explain the formation of rhachischisis and of spina bifida, only to be discarded. Haller, Morgagini, Rokitanski, Föster, and Ahlfeld believed that a primary hydromyelus caused the deformity ; Cruveillier, Virchow, Jensen and others said it was due to amniotic adhesions ; Meckel, St. Hillaire, and Dareste, that the primary cause was an arrest of development of the cord ; Lebedeff, that the central canal was obliterated by excessive bending of the embryo ; Ranke and Koch, that it is due to a persistent attachment between the ectoderm and

[1] Arch. f. Chir., 1894, xlvii. [2] Cent. f. Path. Anatomie, July 15, 1898.

the infolded neural tube ; Marchand, that excessive kyphosis and lordosis means that the cause must be mechanical, and emphasizes the constant connection between splits of the vertebral bodies and hernial clefts of the abdominal wall. Recklinghausen says that that portion of mesoderm which should enclose the cord and separate it from the skin is deficient in growing power, probably due to a defect in the original blastoderm. Richter does not believe in the influence of spinal curves to produce the cleft, and observed that in chicks with experimentally induced anencephalus and spina bifida no trace of any abnormal spinal curve was found. Hertwig, in experimenting with frog's spawn, satisfied himself that the deformity is of very early origin, due to an abnormal process of gastrulation, according as the urmunde remains widely open or not depends the extent of the deformity. He very justly adds that no way has been found as yet to study these processes experimentally in the higher vertebrates. So we are thrown back on the general statement that it is due to an arrest or interruption of the normal process of development occurring probably in the blastoderm of very early embryonic days; or else, as Recklinghausen says, it originates in a deficiency of the growing energy of some of the cells of the mesoderm which no one accounts for. The fluid is a transudation caused by hyperæmia, and does not necessarily accompany vertebral clefts. He regards spina bifida occulta as originally a myelocystocele or a myelomeningocele, which soon after forming burst or shrivelled, and as it collapsed drew down some of the embryonic cells from without the column to become the germ of the future tumor. It is proper to distinguish between rhachischisis and the other forms of spina bifida, because in the first the neural furrow remains open, and in the latter it is closed ; one may reasonably infer that the deficiency of power of growth manifests itself in one case before and in the other after the closure of the neural canal.

Treatment. The treatment of rhachischisics is superfluous: they do not live. Spina bifida demands either surgical treatment or protection, while the associated deformities and paralysis need mechanical treatment—electricity and massage. The death-rate is high, and especially during the first year of life. Demme said that out of thirty-one patients for whom no operation was under-

taken not one was alive when a year old, and twenty-five of them died within the first month. Spontaneous cure does take place occasionally (thirteen cases were reported by the committee of the Clinical Society) ; and all cases where this is suspected from a gradual shrinkage of the sac should be treated conservatively by an appliance affording protection from violence. Spontaneous cure may also take place from rupture and from ulceration, but these processes are also the most common cause of death, and the risk of septic meningitis is too great to justify waiting for nature to accomplish the healing. Protection against rupture and abrasions should be maintained in all cases until the time for surgical intervention arrives. The chief contraindications for operation are marasmus and hydrocephalus. The proper age for operation is usually stated after the child is two months old, because healthy digestion will by that time have been established ; by many it is put off two or more years.

Two methods of operation have been extensively used during the past twenty years—the injection of Morton's solution of iodine and excision. They have been employed indiscriminately for myelocystocele, meningomyelocele, and meningoceles, because of inability to discriminate between them clinically. There are, however, certain distinguishing marks which should enable one to make a differential diagnosis in some cases.

Myelocystoceles are usually the size of a billiard ball or smaller, covered with skin, but sometimes in part with membrane, situated in the lumbar or cervical region, with a small cleft which may be a little to one side of the median line, and usually associated with abnormal spinal curvatures. Meningomyeloceles are usually covered in large part by membrane, are of irregular shape, often like a tomato, are translucent, revealing the presence of bands, nerves, and partitions by irregular shadows when viewed with the hydroscope ; they are found in the lumbar spine or below it, are very uncommon in the dorsal and very rare in the cervical spine ; the cleft is large and wide open ; scoliosis and abnormal antero-posterior curvatures are seldom mentioned. (The following photographs, Figs. 16 and 17, from a specimen in the Warren Museum, show that scoliosis may be present.) Finally, simple meningoceles are more nearly globular, of uniform shape, and extremely translu-

cent; they are usually skin-covered, but may have some membrane at the top, and frequently have a small base. The vertebral cleft is small and narrow, less than three vertebræ involved, and they occur in the sacral or lumbo-sacral region, seldom in lumbar or cervical and rarely in dorsal.

Fig. 16.

Spinal column of a boy of sixteen years of age with double spina bifida, one dorsal and one lumbar, with marked lateral curvature. Two years before death he had caries with lumbar abscess. The bodies of the fifth, seventh and eighth dorsal vertebræ are in two long halves, separated by cartilage in median line. Complete paraplegia and sphincter paralysis. (Warren Museum.)

Although a differential diagnosis is sometimes impossible, where the pathological condition can be recognized the method of opera-

tive treatment should vary to suit the condition. Operators, as a rule, prefer excision to injection to-day—the report of the committee of the Clinical Society to the contrary notwithstanding—

FIG. 17.

Posterior aspect of Fig. 16. (Warren Museum.)

but there have been cures and partial cures of myelocystoceles by Morton's method, and I am not aware of any reported cases cured by the knife. The injection of Morton's solution should, therefore, be preferred to the excision of a myelocystocele. A simple

meningocele pretty generally recovers after a total excision, which should therefore be preferred.

Meningomyeloceles frequently have the cord attached to the top of the cyst. They should be operated by a modified excision or by iodine injection; but the latter has not given as good results in this country as originally claimed for it, nor has excision. The excision should leave the cord unharmed and secure a tight subcutaneous union of the dura which will not leak.

There are times when emergency operations are required.

Whenever a rupture has occurred or is imminent a speedy excision is demanded, unless the condition of the child is such as to make any operation futile. If the child's condition is grave and rupture impends but has not yet occurred, time may be gained by aspiration through the healthy skin at the base of the sac. Deep or extensive ulcerations also demand an emergency excision, owing to the double danger of septic meningitis and of perforation. The writer has recently done an emergency excision on six cases of rupture, three of whom recovered.

The results are less good where excision is done purely to relieve paralysis. It frequently failed to relieve it except in the cases of spina bifida occulta, where the removal of the complicating tumor or of dense fibrous bands pressing on the cord and nerves has cured the paralysis.

THE DIAGNOSTIC VALUE OF RADIOGRAPHY IN ORTHOPEDIC AND GENERAL SURGERY.

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Dr. Weigel made some remarks on this subject, illustrating them by a series of lantern-slides. He said that to be of any advantage the radiograph must be sufficiently good to show the structure of the bone and be free from distortion. Unless the rays were parallel there would be distortion. The X-ray as a means of diagnosis was, in his opinion, exceedingly valuable, and was by no means as fallacious as had been claimed. He never depended upon the fluoroscope alone. He had found difficulty in getting the tube far enough over the table to give the desired results. To obviate this he made use of a tube-holder, sliding on a rail alongside of the table, and adjustable from side to side.

The first picture shown was that of a tubercular focus in the head of the tibia. The boy had had all the typical symptoms, with the exception of tenderness over the condyle of the femur or head of the tibia. The parents refused an operation, and hence fixation-treatment had been carried on for a few weeks, after which another radiograph had been taken. This showed that the process had extended and that a large abscess had formed. The next radiograph was of a foot from a boy who had had a persistent point of tenderness over the os calcis. It showed a well-defined focus corresponding to the painful point. The next picture showed the importance of having the suspected part nearest to the plate, for it had been taken on the other side of the same foot, and did not show the focus just alluded to. The next radiograph was of the foot of a boy who had had a well-defined tubercular disease of the malleolus, and had been operated upon by Dr. Weigel eight years before. There was

no evidence of further disease. The photograph was shown of a foot in which there was lateral swelling, also a radiograph of the same. The next radiograph was of the hands of a person who had a well-defined history of tubercular disease in the family. She complained of pain in the wrist, and the radiograph showed disease in the lower end of the radius. After a short course of treatment another radiograph showed that the periosteum had smoothed out and that recovery was taking place. Radiographs of two hands were shown—one normal and the other diseased—showing the increased development of the carpus in the affected one. The next radiograph was of a foot from a child having a well-defined tubercular disease of the os calcis. In such cases the bone became diminished in density, and as a result appeared lighter than normal. The next radiograph was of a pelvis, showing the extensive ravages of hip-joint disease. One notable feature in this and in several other similar cases was the marked atrophy of half of the bony pelvis situated on the affected side. A second radiograph bearing on this point was exhibited; it showed the atrophy so markedly that he had taken two or three radiographs before convincing himself of their accuracy. The next radiograph showed a very extensive hip disease extending into the pelvis and over onto the opposite side. The next radiograph was from a gentleman who had fallen upon the ice and had apparently been only slightly injured. After a few weeks there had been ankylosis of the elbow, and the adhesions were broken up two or three times under anæsthesia. Two or three competent surgeons had failed to detect any fracture, yet the radiograph showed plainly a fracture of the tip of the olecranon. This had been taken eight or ten weeks after the injury. The next picture showed a fracture of the tip of the acromion which had not been diagnosticated by two or three surgeons. The next showed a dislocated cartilage of the knee. Another radiograph showed an unsuspected fracture of the astragalus. The next picture was of a thorax in which there had been what quite a number of physicians had thought was a distortion from rhachitis. There had evidently been some softening of the ribs occurring during the past three or four years. The radiograph showed a slight shadow which physical examination of the chest showed corresponded to an area of decided dulness. It was apparently a pulmonary infarction, and the subsequent history of

the case supported this view. The next radiograph was of a hand in which there was a fracture of the wrist through both bones of the forearm. The radiograph also demonstrated that the adventitious deposits could be readily differentiated by the X-rays. The next picture was from a man who had fallen down an elevator-shaft and sustained a fracture of the external condyle. The functional result being poor, a radiograph was taken a few weeks later and revealed a fracture, with displacement of the fragment. The next radiograph was from a woman who had had a painful wrist for several months. She had been treated for an evident fracture, and the radiograph showed the fracture still ununited. The next slide was from a case in which the diagnosis had been made by exclusion; it showed a false ankylosis of the knee, which quickly yielded when the adhesions had been broken up under anæsthesia. The next slide showed stiff fingers and the deposits therein. The next showed a complete convex bending of the ulna, which prevented complete pronation and supination. The next was of a man who had a painful swelling of the hand. The picture showed that the epiphyseal junction of the metacarpal bone of the thumb and carpus was diseased. The next radiograph showed a fibrous ankylosis of the lower jaw. The next one showed an elbow which had become completely ankylosed as a result of a bicycle accident. The next one was from a case in which it could not be determined by other means whether the ankylosis of the knee was true or false. It turned out to be the latter. The next radiograph showed a fracture of the os calcis, and the next a traumatic flat-foot with well-defined fracture of the os calcis. The next slide showed a hand which had been the seat of septic infection and in which the tendons had sloughed out. The next two pictures were from cases of anterior metatarsalgia. After that was a slide from a case of gonorrhœal rheumatism of the knee. Another photograph was presented showing a congenital dislocation of the hip. In this case he had tried the bloodless method faithfully, but had only succeeded in converting the upward dislocation into an anterior one. A radiograph was shown of a case in which Dr. Moore and several other surgeons had insisted upon the case being one of fracture of the neck of the femur; but two years later the photograph showed a dislocation upward of the head of the femur onto the ramus of the pubes. The next picture was from a case of dislocation

of the head of the femur during convalescence from typhoid fever. The next radiograph was of a severe case of club-foot, and the next an exceedingly severe form of flat-foot. The next slide exhibited a radiograph from an ordinary case of scoliosis. Another radiograph, which was intended to be one of a case of hip-joint disease, really showed a number of beautiful striations, apparently produced by the static discharge. The next radiograph was from a woman who was said to have grown several inches shorter in the last few years. It revealed nothing but atrophy of the bones. The last slide shown was of a gunshot injury of the arm.

DISCUSSION.

Dr. Lovett asked what apparatus Dr. Weigel had used, and what had been the average exposure in the radiographs exhibited.

Dr. Weigel replied that he had used the static machine, as he considered it safer and far better than any other apparatus, and the exposures could be fully as short as with other apparatus. For an adult foot, with the tube at a distance of eighteen inches, the exposure would be about three minutes, whereas in the case of a child it would be about forty seconds. For any size of hand, the tube being at a distance of eighteen or twenty inches, sixty seconds would be sufficient. For the spine, with the tube at twenty-four inches, an exposure of about twenty minutes would be required. The hip of a child could be taken in from three to ten minutes, and an adult elbow could be done with an exposure of about five minutes. The knee would require five or six minutes. The exposure should be long enough to give the detail of the structure of the bone. He had been using the X-rays for two years and a half, and had never seen the slightest burn. He had used a coil for one year without producing a single burn, and he had then discarded it for the static machine. Another party had used this same coil and had produced in a short time three severe burns, one of them so extensive that it had been followed by gangrene. The burns were produced by the tube being placed from four to six inches away. Personally, he never brought the tube nearer than twelve inches, and usually it was eighteen or more inches distant.

NON-TUBERCULAR INFECTIOUS PROCESSES IN BONE.

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AND

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Holmes says in his *System of Surgery* that osteomyelitis is a disease more frequently recognized on the autopsy table than at the bedside. The statement is less true now in these days of bacteriology, though undoubtedly cases are not recognized as frequently or as early as is desirable.

When Chassaignac first described this condition, in 1853, he called it "typhus of the limbs," recognizing at that time only those fulminating cases in which the patient so quickly falls into the typhoidal condition, with disseminated foci of suppuration; but it is now known that the symptoms may vary very widely, according to the nature of the infecting organism, the virulence of the culture, apparently the resistance offered by the individual to this infection. Cases may end fatally in thirty-six hours, as described by Park, or others of a subacute or chronic form, and equally due to pus-producing organisms, may continue for a long time with but slight rise of temperature.

The disease is almost unknown in the aged, is rare in adults, while in infants, and particularly in young children from five to twelve or fifteen years of age, it is very common. As regards sex, in infants it is about equally divided, but the disease among older children is more common in boys, due doubtless to the greater frequency with which they receive blows and injuries, which seem to act as a predisposing cause, as well as to the greater frequency with which they have small infected wounds which give entry to the organisms. Its favorite seat is in the shaft of one of the long bones near the epiphysis. Nor does

the disease always confine itself to a single bone, two adjacent bones may be involved, though this is rare. Occasionally, though rarely, we find two separate foci which appear simultaneously; this form of the disease seems to be more common in infants.

It is now known that osteomyelitis, the name which has been applied generally to all infections of bone, is not the simple disease it was at one time supposed to be—that is, an infection of the bone-marrows, the staphylococcus aureus. Klebs found that the streptococcus could produce the lesion, then the bacillus of Eberth was found to be a cause; later, the pneumococcus of Fraenkel, the colon bacillus, the staphylococcus cereus, and bacillus pyocyaneus were all found in the pus of these cases. The various forms of staphylococci are undoubtedly the most frequent cause. Rosenberg found in 15 cases staphylococci and in 14 streptococci but once. Lannelongue, out of 130 cases, found 103 in which the staphylococcus was present. On the other hand, Koplik and Van Arsdale found the streptococcus in 4 successive cases. Keen, Parsons, and several other writers report a large number of cases in which the typhoid bacillus was found, while of late numerous cases of pneumococcus infection have been noted. Among others, Blecher gives 9 cases, following a long infection, 3 in adults, 6 in children. In one of the cases of infection ascribed to the pneumococcus the child had a nasal discharge which gave a culture of pneumococci, but no consolidation was found in the lungs.

As regards the method of infection two conditions must be present. There must be a region of lowered resistance, a vulnerable spot, also an avenue of infection.

The point of lowered resistance may be brought about by a slight injury, such as a blow or kick; exposure to cold seems to have been a sufficient cause in many instances. Lamothe has found the trouble more prevalent in the winter months. Senn also has spoken of the influence of cold acting by producing circulatory disturbances. Acute disease often lowers the power of resistance, so that the affection is not uncommon following the exanthemata. The usual seat of the infection is undoubtedly the marrow of the long bones near the epiphysis; however, it may occur elsewhere, even in the epiphysis itself. Lannelongue denies that primary infection can take place just under the periosteum. This, however, probably occurs at times.

It is also probable that the infection is able to pass from without in,

as well as from within out. The infection is brought by the blood stream, and, as in the leg, the nutrient arteries run toward the joint, we find the lesions occurring most commonly in either the upper end of the tibia or the lower end of the femur. They are much more common here than in the upper limb, quite possibly due to the more frequent blows received. Some writers consider the tibia the bone most often infected, others the femur. In the cases we have investigated the femur was infected most often, but both are infected with nearly equal frequency.

In the upper limb the infection also travels in the direction of the blood stream, so we find the head of the humerus and the lower end of the forearm the common places. While the above mentioned are the places that are most often attacked, no bone seems to be exempt, the tarsals and carpals, the ribs, vertebræ, sacrum, ilium, and skull being occasionally the seat. The exanthemata, and in certain cases tonsillitis, scarlet fever, typhoid, and pneumonia, seem to furnish both the lowered state of general health and the infecting organisms.

The source of infection is often a slight external wound or abrasion which has become septic. Apparently a little break in the skin, such as a blister caused by a poorly fitting shoe, has given entry to the infection. With the new-born the stump of the umbilical cord is a common channel of infection; the lesions in the various gastro-intestinal disturbances, bronchitis, ophthalmia, otitis media, all have acted as the port of entry for the organisms. As the infection is through the circulation, any way in which pus-producing organisms may be brought in contact with the blood stream may act as the immediate cause of the trouble.

Nichols describes the pathology in substance thus: Organisms are deposited in the marrow by means of the blood, the toxins produced bring about a necrosis of the surrounding cells. There is an exudation of polynuclear leucocytes, injection of the vessels, and more or less hemorrhage. This process may extend up or down the shaft. If in the medulla this suppuration often extends through the Haversian canals and strips the periosteum up for a considerable extent. This stripping up of the periosteum is combined with more or less thrombosis in the vessels of the bone.

From the pathological appearance it would seem that the epiphyseal line acts as a barrier to the progress of the disease. It is certainly

true that a process beginning in the shaft seldom extends into the epiphysis, but perhaps this is due to the fact that the epiphyseal line acts as a vent rather than as a barrier. In observations on quite a number of cases giving a history of a medullary infection, abscesses appeared in the region of the epiphyseal line.

Symptoms. The disease in the typical case begins with an acute onset, usually pain and tenderness over the region of a bone, a rapid pulse and high temperature, and with these there are also the usual symptoms which accompany the onset of acute febrile disease in children, vomiting, convulsions, restlessness, and delirium. Redness of the skin does not appear, as a rule, until the condition has gone on some little time, nor does fluctuation or any considerable amount of brawniness appear before the pus has perforated the bone, and usually the periosteum also. There can, however, be a certain definite thickening of the bone, said to be due to swelling.

The above describes a typical case, but many cases are met in which the onset is quite different. In some cases reported by Koplik and Van Arsdale the children were very ill, and yet the only sign presented was an effusion in certain joints; these were opened and contained pus, which showed streptococci. In all four cases it was found that the original focus was in the bone, some distance away. Of these four cases three died.

Differing from these are the post-typhoid cases, in which a subacute condition is present, the only symptom being more or less pain over a bone; in some cases without a rise of temperature, but with the subsequent development of a sinus leading to necrotic bone. In a certain number of these cases pure cultures of typhoid bacilli are found, in other cases mixed cultures of typhoid and some pyogenic organism.

One particular type of this disease, which Edmund Owen has called attention to, and of which the writers have observed cases, is that attacking the head of the femur or the ilium. The symptoms are those of hip disease, usually acute in onset and unusually severe, and until it has progressed to a considerable extent can only be diagnosticated by inference; the more acute onset, greater prostration and the greater leucocytosis being of significance.

Besides these there is the septicæmic or fulminating type, of which great prostration and delirium, with a high temperature and

rapid pulse and early death, are characteristics, with metastasis in nearly all the joints and the skin, pericarditis, and pleurisy.

To recapitulate, the symptom may be definite and classical, or, on the other hand, they may be most vague, and present in certain cases nothing definite, but simply the picture of a severe illness.

Diagnosis. In making the diagnosis we must consider rheumatism, particularty in those cases where the lesion is near a joint, and the joint symptoms are the predominant ones; here the presence or absence of leucocytosis may be of aid to us. However, if there is any serious doubt, a clean aspirating needle properly used is certainly fairly free from danger.

In those cases which are near the hip we will have to consider tubercular ostitis, but the more acute onset of the acute infectious disease will usually make the diagnosis fairly plain.

Prognosis. The prognosis, which in these cases depends on several factors, is, as a rule, good, so far as life is concerned. The prognosis in the individual case depends on the seat of the disease and the sort of organism present; the virulence of the culture, the resistance of the individual, and upon early and vigorous treatment.

As regards the different organisms, the streptococcus is generally supposed to be most dreaded. Koplik and Van Arsdale lost three cases out of four, in which there was a streptococcus infection of the joints secondary to a focus in the bone. It is true that most of the fulminating cases which show signs of general septicæmia are due to streptococci. This infection seems to be rather more common in infants and more apt to involve the joints.

The various forms of the staphylococci, which are the organisms commonly found, seem to produce a more destructive process locally, and there seems to be a greater tendency to have abscesses burrowing about in the surrounding tissues. A very large number of the fatal cases have shown this organism, but that is to be expected, as this organism is found in by far the majority of cases reported. The tendency to joint involvement seems to be somewhat less.

Of the pneumococcus cases, most seem to be marked by this rather benign course, though fatal cases are recorded.

The same applies to the typhoid. Klein has reported a fatal case in the femur; in this case, however, the typhoid bacilli were associated with colon bacilli. Their peculiarity is the persistence of the

sinus. A case has been reported, opening spontaneously, in which the typhoid bacilli alone were found after six years. From this it would appear that many of the so-called "fever sores," with histories of having persisted for years, may be due to this cause.

One interesting case is reported by Bosquier, a case of thirty-nine years' duration, in which in operating he found little perfectly distinct areas of disease. These contained the staphylococcus albus in pure culture. The cultures from this at first produced no action in guinea-pigs, and took stain badly, but after being cultivated a little time they regained their usual characteristics and virulence.

Lediard has recently tried the antistreptococcus serum in a case with general infection. The patient died, but as the culture showed diplococci as well as streptococci, one could not have expected success from the use of the serum.

In the diagnosis of the sequestra, which could not be felt by the probe, Hahn and Birch-Hirschfeld have recently been successful in locating these by skiagraphs.

Separation of the epiphysis may occur, and in these cases the growth of bone in length is greatly curtailed. In the hip the bone has been found in an abscess cavity after an attack of three or four days' duration. In certain cases, as in the lower leg and forearm, we may have a great compensatory hypertrophy of the sound bone, which partially makes good the deficiency. On the other hand, by the growth of the well bone, when the centre of growth in the other has been destroyed, we may have the limb greatly bent.

In rare instances a spontaneous fracture occurs when the shaft is necrotic, and the involucrum of bone is too weak to support weight. Such a case has been recently reported by Birch-Hirschfeld.

Besides these, we see a certain number of cases in which ankylosis of the joint has followed, although during the active disease there has been no evidence of suppurative ostitis other than pain and swelling about the joints. In these cases contraction at the joints, accompanied by ankylosis, produces a disability which may seriously cripple.

Little need be said as to the treatment of these cases, as the surgical indications are clear. Free incisions with active antisepsis should be made wherever there is reason to suspect the development of suppuration, or that suppuration will develop; and in cases of

high temperature, if the place for incision can be determined by pain or swelling, trephining and chiselling of bone for the drainage of pus may be necessary.

The following illustrative cases may be quoted as indicative of the variety of symptoms presented:

Case I.—A girl, aged five years, whose family history was unimportant. Four days ago she was jumped upon while at play. There was pain that day, which increased later, and the patient has not been able to bear weight on the leg since. There is no motion in the affected hip and no swelling, but marked tenderness in the parts, and night cries, also an elevated temperature with a rapid pulse. An incision was made on the anterior surface of the upper part of the thigh, outside the vessels, and two ounces of pus were found below the neck of the femur.

After the first operation the temperature fell, but subsequently rose. The patient was again anæsthetized and the neck of the femur trephined; no focus was found, the wound was washed with corrosive. The patient's condition improved. The culture showed staphylococci.

Case II.—A boy, aged eight years, who fell on the ice eleven days before, striking his leg. Two days after the accident the child had a good deal of pain, the leg became hot and tender; all these symptoms persisted.

On entrance to the hospital the right leg was found swollen from just above the ankle to half-way up the thigh; the swelling was most marked just below the knee, where it was fluctuant. The knee was held in position of forty-five degrees of flexion, and fluctuation was made out in the joint.

An incision was made over the upper and inner part of the tibia; the periosteum was found dissected up from the line of the epiphysis above, some little distance downward. A half-ounce of pus was evacuated. The tibia was opened with a chisel for about six and a half inches; the cancellous tissue of the head and shaft was found purulent and removed, though the proximity of the epiphysis prevented the complete removal above; staphylococci were found in the purulent material.

The fluid in the knee-joint persisted, and ten days afterward the knee was aspirated, because the child had a chill. Pus was found which showed streptococci. The joint was then opened freely and some three ounces of pus were evacuated. After that the child made a good recovery.

Case III.—This boy, aged eight years, was brought to the hospital with a temperature of 102.5°. The history was that he was well up to four days ago, when he had a fall, which was followed shortly by pain in his right hip. This pain was severe enough to keep him awake nights. Yesterday he could walk, but it was painful, and he limped badly; to-day he cannot walk at all.

Examination. Leg held in a position of flexion. The knee is somewhat red and swollen, and very sensitive to manipulation. Over the outer condyle is a brawny mass the size of half an English walnut, which is painful and tender. Child was put up in a plaster bandage extending from the toes to the groin.

On the following day an incision three inches long was made above the internal condyle. This was carried down to the periosteum, which was found distended and fluctuant; the pus had dissected the periosteum up from the greater part of the lower third of the femur. The periosteum was incised and exit given to pus; the bone beneath was bare and seemed necrotic. Over the outer condyle a similar incision was made and a little pus evacuated.

Cultures from the pus showed the staphylococcus albus. Several months later a sequestrum about one and a half inches long was removed. The first operation was two years ago. The boy when last seen, some months ago, still had a discharging sinus.

Case IV.—This was a girl, aged three years, who fell on the floor two weeks before, and had had pain in the left thigh since that time. She had walked a little, but it hurt her, and she limped a good deal. Three days after the fall her mother noticed a swelling on the inside of the left thigh, which had increased steadily. Her appetite has been poor.

Examination showed left thigh much swollen and tender, also considerable redness. The tenderness was more marked in front. There was deep fluctuation, with induration on the edges. Motion

at both the knee and hip was limited. The day after entrance an eight-inch incision was made on the front of the thigh, which was carried through the tissues down to the bone. Some six ounces of pus were evacuated and the periosteum found stripped from the femur for a distance of about six inches. Culture from the pus gave staphylococci. Four months later the wound was solidly healed.

Case V.—This was a boy, aged nine years, who gave a history of a bad cold some six weeks before. After the cold his thigh was bruised by being struck with a stone. After the blow it grew steadily more painful, up to the day before entrance, when there was a sudden increase in the amount of pain.

Examination showed a poor pulse, with a temperature of 101.2°. The right foot and leg were much atrophied, while the right thigh was very much swollen and tender; no fluctuation could be made out. The hip was held in a position of flexion and abduction, and admitted of no motion.

Though the boy ran a constant temperature, which often went above 102°, and had a leucocytosis of 28,000, yet some things made it seem like a sarcoma, so operation was delayed.

One month after entrance an incision two and a half inches long was made parallel with the axis of the thigh and just anterior and below the great trochanter. Just under fascia a layer of inflammatory tissue one inch thick was cut through. On incising the periosteum four to five ounces of pus escaped and the periosteum was found dissected up for from one-quarter to one-third the length of the femur.

The cultures from the pus showed the staphylococcus albus. The child made a good recovery, but when it disappeared from observation, some four months later, he still had a discharging sinus.

Case VI.—A female child, aged ten months, who had been well save for an occasional gastro-intestinal attack.

Four days before entrance the child began to cry incessantly. There was apparently tenderness and pain about the right arm and shoulder. For the two days previous to admission the child was apparently feverish and had a slight gastro-intestinal attack, with vomiting and green dejections. There was no history of an injury.

Examination showed face flushed, tongue coated, a temperature of 103.6°, with rapid pulse and respiration. Right upper arm was swollen and fluctuant, with the fluctuation most marked on the anterior surface of the arm. There was great tenderness on manipulation, also enlargement of the axillary glands. On the day after admission an incision was made on the anterior surface of the arm from the coracoid process above nearly to the elbow. It was carried down to the bone near the bicipital groove, when about half an ounce of bloody pus was found. Bacteriological examination showed an abundant growth of streptococci. The child made a good convalescence, and ten months later the wound was solidly healed, with nearly full motion in the shoulder-joint.

Case VII.—This boy, aged seven years, had a swelling of one elbow some six months ago. Sometime later his left knee became swollen, which was followed shortly by pain in the right hip. Since that time he has not been able to stand, and is unable to use right hip or left knee.

Examination showed both thighs flexed on abdomen, the right in a position of adduction, the left in an abducted position. The left knee cannot be extended beyond a right angle. The pelvis is tilted, so that the boy stands like a case of congenital dislocation of the hip. One week after entrance both hips and the left knee were straightened manually. Twelve days later the boy developed measles. Six days after the onset of the measles the child had pain in his left knee; four days later the knee was red, tender, swollen, and fluctuated. The right knee then became flexed and was straightened under ether; at the same time the left knee was incised and pus evacuated. The culture from this pus showed staphylococcus albus.

In a few days the boy developed an abscess below the left knee, which was opened, also one over sacrum, which was also incised. At the time this paper was written the child was still in the hospital and convalescence was well advanced, although he still had discharging sinuses.

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POTT'S PARAPLEGIA AS AFFECTED BY THE CORRECTION OF THE SPINAL DEFORMITY.

A Report of Cases.

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Until the past two or three years the commonly accepted treatment of Pott's paraplegia consisted of rest in bed, with as thorough fixation of the spine as possible, together with the less common but frequent use of traction and counter-traction.

The duration of the paralysis varied with the location of the disease and the age of the patient. Rarely did it disappear before six months, and that in children, while in adults few recovered in less than eighteen months or two years. In a certain number of cases, even after a longer period of time and under the most careful treatment, the power failed to return. This has formerly been considered to be due to degeneration of the cord, and, consequently, it was supposed that the condition was hopeless.

Various theories have been offered in explanation of the paralysis, such as abscess; direct pressure of the softened vertebra upon the cord; pressure due to a tuberculosis of the meninges, the tubercular process extending into the cord itself, involving the interstitial tissue surrounding the nerve fibres; an œdema of the cord, due to imperfect circulation at the seat of the disease; and probably others which have escaped my notice or memory.

As the result of the work which has been done during the past three or four years, in connection with the correction of the spinal deformities, the course of the paralysis has been changed in so striking a degree that it becomes necessary for us to reconsider some of our former views, and it may be possible, by studying a group of such cases, to speculate more definitely upon the exact etiology of the symptoms.

The most striking fact in treating these cases is that, whatever the etiological factor may be, the correction of the spinal deformity, or only a partial correction of the deformity, has been followed by a very rapid and at times an instant relief from the paralysis. This result has been so universal in my own experience, and so common in the hands of others who have pursued the same method, that while at first the disappearance of the paralysis was supposed to be only a coincidence, coming in connection with the correction of the deformity, at present the correction of the deformity has come to be of secondary importance to relief of the paralysis which is to be accomplished in this way.

In my own experience of the eleven cases which have been treated in this way all have shown a marked improvement in the motor control of the legs within a few days of the time of treatment. In some of the cases, either because of the location of the disease and the inability to hold the spine in the corrected position, or because of inability to control the after-treatment, it has not been possible to make the improvement permanent, and relapse has occurred. The fact, however, that the paralysis has been relieved by the change in the position of the spine has been demonstrated and the demonstration repeated several times in one of the cases.

Of the eleven cases, five were reported at the last meeting of this Association, in the paper entitled "Forcible Straightening of Spinal Deformities Resulting from Pott's Disease," and they are again mentioned because the subsequent history of the cases is of fully as much interest as the immediate result.

Of the eleven cases three were children; of these, one with disease in the upper lumbar region was entirely and almost immediately relieved by hyperextending the spine. Ether was not used, and after one year, during which the position of the hyperextension has been maintained, there has been no return of the paralysis. In another child, with disease of the first and second dorsal vertebræ, the weight of the head alone was not enough to correct the deformity, so that ether was used for this purpose. This was followed by marked improvement in the control of the legs, but the improvement lasted a few days only. The treatment was repeated once or twice with the same result. Each time the paralysis

was relieved, but the improvement lasted only a few days, the relapse being due undoubtedly to the inability to maintain the corrected position because of the location of the disease. The child is none the worse for the treatment, and is now being treated as formerly—in bed, with immobilization of the spine. The third child, with a large deformity in the mid-dorsal region and with complete paraplegia, was considerably benefited by the improved position of the spine, but the improvement has not been permanent.

Of the eight adult cases five were men. The oldest patient was a man, forty-three years of age. In only one of the cases was ether used, and this was before the apparatus which is now in use had been perfected. At the present time I feel sure that even in this case ether would not have been necessary.

Of this group of adult cases, one of the most suggestive and interesting, from a physiological as well as a pathological point of view, is the case of the man, forty-three years of age. In this case the disease of the spine had been present for about six years. During the first part of the time he was under my care at the Carney Hospital, but paralysis developing, and having no home, he was sent to the Almshouse Hospital at Long Island, and there he had lain for four years previous to the commencement of the present treatment. While at Long Island he was under the care of Dr. E. W. Taylor, and it was through his kindness that it was possible for me to see him. The knuckle was in the mid-dorsal region, and there was, with the exception of a slight tremor in three middle toes of the right foot, absolute paralysis of everything below the waist, together with a partial paralysis of the bowel. The knees and ankles were stiff, while the feet were not only stiff but were fully extended, so as to be in a straight line with the legs instead of at a right angle to them.

The patient was transferred to the Carney hospital in July of last year and a plaster-of-Paris jacket applied, with the spine in the hyperextended position. In a few days he could move the toes of both feet, but because of the long disuse the cerebration was uncertain for some time; for instance, when asked to move the right foot the left one was perhaps the one moved, and *vice versa*. This gradually improved, however, so that later the cerebration was in no respect peculiar.

Since July jackets have been applied about every six weeks, so that the spine has been kept constantly hyperextended. Ether has been used but once, and that not for the spine, but to free the contractions and adhesions about the knees and at the ankles. There has been a gradual improvement in the voluntary control of the muscles of the legs, so that at the present time there is a response in practically all. The improvement has naturally been slow, as after four years of absolute disuse the muscles had undergone the most extreme atrophy. The rectus femoris, for example, was at first represented under contraction by a small band not wider than one's finger and not as thick, while at present, even though it is still very small, it has developed sufficiently so that when the knee is raised, flexing the joint thirty or forty degrees, the patient is able voluntarily to lift the leg from the bed and straighten the knee.

At the present time the patient is able to stand with the aid of crutches, and by being steadied can swing himself along the length of the ward.

The case is of interest even though there be no further improvement, which is possible, as he has recently developed tuberculosis of the genito-urinary tract, as it demonstrates that the function of the spinal cord can be wholly arrested for at least four years, and still retain a portion at least of its power of transmitting impulses.

Of the other cases, one of especial interest is Case IV., a young woman, twenty-one years of age. Paralysis has been present for about eighteen months and the disease for four years. The patient was first treated in January, 1898, with almost instant relief from the paralysis, so that in one month she was walking about. She then became and has since remained an out-patient, reporting about once in six weeks to have the jacket reapplied. The point of special interest is that during the extreme heat of last summer her request to have a removable jacket was granted, the understanding being that the jacket was to be opened only when lying down. One week from that day the patient was brought to the hospital with paraplegia. She was sent to the ward and a jacket applied the following morning. As soon as she was put in position on the frame—no force being used other than her own weight—she remarked: "Now my legs are all right." The jacket was

applied, and that afternoon she left the hospital, walking as well as ever. There has been no trouble since except once, when the jacket had softened considerably—the legs were said to feel weak and unsteady. The new jacket entirely relieved this sensation.

In two of the other cases there has been a temporary return of the paralysis, due to the softening of the jacket, and in both cases the condition has been relieved at once by the correction of the position of the spine in applying a new jacket.

The following case (Case XI.) is mentioned rather more in detail, as it represents a somewhat different condition, and the marked improvement which followed the treatment was more unexpected than in the other cases. With this one exception the cases which are here reported had developed the paralysis in connection with the acute or active stage of the disease. In this case, however, the active disease in the spine had occurred many years before, the spine having become ankylosed in the position of extreme deformity. In such a condition naturally very little was expected as the result of any attempt to correct the position of the back, the paralysis presumably being due to a late suppurative process developing in the rigid canal, and thus causing pressure. The actual result, however, in this case was equally as striking as that obtained in the others. The paraplegia was much lessened by the application of the first jacket, and after the last one, which represented the third jacket, she was able to be up and move about. In this case the sensory paralysis which was present was likewise relieved.

The cases in detail are as follows:

Case I. M. A., a boy, eight years of age, with disease of the upper lumbar spine of two years' duration. Paraplegia developed one year ago, and was entirely relieved by hyperextending the spine, without ether. Plaster-of-Paris jackets have been worn since then, the same position of the spine being continued. There has been no return of the paralysis as far as the motor control is concerned, but the knee reflexes are more lively than normal. There is no ankle clonus or noticeable weakness of the legs.

Case II. J. F., a boy, six years of age, with high dorsal caries of one year's duration; during that time he had been under treat-

ment with the usual braces. A few months ago paraplegia developed, which was complete at the time of my examination. Ether was used and the spine straightened, with marked relief, so that the child was able to move the legs about quite freely. In a few days, however, the paralysis returned, owing probably to the location of the disease and the inability to hold the spine hyperextended. The same manipulation was attempted two or three other times, and each time there was the same improvement, but also the same relapse in a few days. The child is none the worse for the treatment, and at present is being treated by recumbency with as thorough fixation as is possible.

CASE III. R. L., a girl, aged eight years, with Pott's disease of three years' standing, and quite a marked knuckle. She was treated at the Good Samaritan Hospital. Several attempts were made without ether to hyperextend the spine by both Dr. Thorndike and myself, and while two of the attempts at least were followed by improvement, it was of but short duration. At present the paralysis is the same as before the treatment was begun.

ADULTS.

CASE IV. K. St. J., a young woman, aged twenty-one years, with Pott's disease of four or five years' duration. There was a marked deformity, and paraplegia had been present for nearly two years previous to the time of the correction of the position of the spine. Ether was used, and after the correction a plaster-of-Paris jacket was applied. The paralysis was relieved at once and there has been no return, except once when the jacket was partially removed at home, and once or twice when the jacket had softened. At each time the correction of the position and a new jacket has relieved the trouble. The knee-jerks have remained much exaggerated. There is no ankle clonus and the voluntary motor control is normal.

CASE V. T. D., a man, aged twenty-one years, with disease in the mid-dorsal region of two years' duration. Paraplegia, in which the bowel also was involved, developed twelve months ago. The position of the spine was corrected without ether with instant

relief of the paralysis. An abscess has developed since the treatment was commenced, but there has been no further trouble from paralysis, either of the legs or bowel, except once, when there was a slight temporary return, due to the softened jacket. A new jacket entirely relieved the difficulty. The knee reflexes are still exaggerated.

Case VI. H. G., a man, twenty-six years of age, with disease in the lower dorsal region of two and one-half years' duration. Paralysis had been present, with the bowel also involved, for six months prior to the treatment. The correction of the position relieved the paralysis at once, and there has been no trouble during the past year, except slight temporary trouble when the jackets have softened.

Case VII. A man, thirty-six years of age, with mid-dorsal Pott's disease of comparatively short duration previous to the time of the first examination, in April, 1898. At that time there was also disease of one knee-joint. The treatment for the spine was imperfectly carried out, owing to the fact that the patient lived at a distance from the city; but with the one jacket, with an improvised apparatus, there was a marked control in the motor control of the legs. The treatment was discontinued and the paralysis returned.

Case VIII. T. M., a man, aged twenty-nine years, with disease of the mid-dorsal spine of five years' duration. At the time of the first vist at the Carney Hospital, in January, 1899, there was well-marked paraplegia. This was entirely relieved by the application of a jacket in the hyperextended position, and there has been no trouble but once, when the jacket had softened.

Case IX. T. D., a woman, aged thirty-two years, with disease in the upper lumbar region of two years' duration. Paralysis had been present for about three months previous to her admission to the Carney Hospital four weeks ago. A jacket was applied in the hyperextended position, and there has been a steady improvement, so that the patient is now able to walk about.

Case X. P. M., a man, aged forty-three years, with disease in the mid-dorsal region of six years' duration. For four years previous to beginning the present treatment he had lain on his back in the Almshouse Hospital, at Long Island (Boston), with absolute paralysis of both legs from the waist down, together with paralysis of the bowel. It was through the kindness of Dr. E. W. Taylor that I was able to see the patient. Nine months ago he was transferred to the Carney Hospital. At that time there was absolutely no voluntary muscular movement below the waist, except a slight tremor in the three middle toes on the right foot, and this was so slight as to escape notice unless carefully looked for. Both feet were fully extended at the ankle, and were rigid, partly due to joint adhesions and partly to muscular stiffness. The knees or hips also could not be bent. The legs were œdematous, and the circulation, as shown by the condition of the skin, was very poor. Without ether the spine was hyperextended and a jacket applied. Within a week there was distinct voluntary movements in both legs. A few weeks later, under ether, the tendon Achilles were cut and the joints of the legs manipulated. Until four months ago the patient made a steady gain, so that there was a voluntary response in practically all of the muscles of the legs. At that time a tubercular process developed in one testicle, necessitating surgical interference and a temporary discontinuance of the treatment for the back. For the past three months the spinal treatment has been continued, together with the manipulation of the legs, and even though there are some signs of a tubercular process higher up in the genito-urinary tract, the improvement has gone on so that there is enough strength in the anterior thigh muscles to raise the foot from the bed and straighten the leg when the knee had first been flexed and supported. With the aid of crutches and an assistant to steady him he is able to walk the length of the ward. The improvement has been so steady that were it not for the manifestation of the disease in the other organs I feel very sure that he would be able ultimately to go about independently.

Case XI. Miss E., a woman, forty years of age, with a large, rounded kyphosis invading the mid-dorsal region, which had developed over twenty years before. In 1892 there was an attack of

paraplegia lasting for three months. In September of last year the paraplegia again developed, with sensory disturbances. The reflexes were extremely exaggerated and the voluntary motor control entirely lost. The patient was seen in consultation with Drs. S. A. Lord and C. F. Painter. A jacket was applied with the spine hyperextended as much as possible, and since then three or four other jackets have been used. With each the paralysis has lessened, so that at present the patient is able to walk about freely.

The apparatus which was used to obtain the desired position of the spine was described and pictured in a paper read by me before this Association at the meeting held last year, and afterward published in the *Boston Medical and Surgical Journal*, July 28, 1898.

DISCUSSION.

Dr. Gibney, of New York, said that he desired to congratulate Dr. Goldthwait and the Association on the results obtained. He was particularly pleased with the frame exhibited. A former house-officer at the Hospital for Ruptured and Crippled had been delighted with the use of this apparatus, but the present one had not appreciated its good points and had shown a disposition to go back to the swing.

In connection with the cases reported in the paper, Dr. Gibney said he would like to refer briefly to the case of a man whom he had had under observation about four years ago with dorsal Pott's complete paraplegia, general trophic disturbances, and paralysis of the bladder and rectum. He had worn jackets for three or four years, and had grown steadily worse. Dr. Gibney had suggested a few months ago that relief might be afforded by putting him on the frame, but had finally compromised on a laminectomy. Dr. Robert Abbé had done the operation, and on cutting down upon the canal a mass looking like granuloma had been exposed; it had completely filled the canal. After scraping away this mass and exposing the cord the latter did not pulsate at all, but was found flattened out like a ribbon. On relieving the pressure above and below, and removing some more of this tissue, the flattened meningeal tissue had become more highly colored, and in a few minutes had begun to

pulsate. Facing the anterior wall of the fifth or sixth rib was a tumor apparently of the same material, which was also taken out and a drain inserted. Dr. C. L. Dana had been in consultation over the case with Dr. Gibney, and they had decided that it was not advisable, in view of the patient's rather poor condition, to operate further at that time. After two or three days the man's temperature had nearly reached the normal, and he had steadily improved, although he had not yet begun to walk. What the ultimate result would be could not, of course, be stated.

Dr. Sherman said that the method devised by Dr. Goldthwait had been in use in the Children's Hospital, San Francisco, ever since the first description of it had been published. He had not worked with it personally, preferring to have it all done by his associate, Dr. Huskin, in order to secure greater uniformity. All the children coming to the hospital had been subjected to the treatment, but only one of them had been paralyzed at the time. This girl had been in bed for upward of three years. A jacket had been applied, but there had been no sudden and marked recession of the paralysis. He asked if it were possible that there had been a hysterical element in the young woman referred to in the paper, in whom there had been such marked exacerbations in the paralysis. Personally, he was inclined to consider this an explanation in that case.

Dr. Lovett, of Boston, said that he had had occasion recently to look up the literature of pressure paralysis, and had found that the later writers had laid much more stress than the earlier ones on œdema as the cause of the pressure symptoms. The only way in which the immediate results described by Dr. Goldthwait could be accounted for was by a change in the œdema. Schultze, in his last work on the subject, had laid a great deal of stress upon the influence of œdema. The change was supposed to be at first circulatory, and later, inflammatory.

Dr. Sherman said that in the case mentioned by Dr. Gibney it was difficult for him to understand how œdema could be present in a cord subjected to compression. It was usual, he thought, to find a quantity of granulation-tissue in the canal, and also more or less cheesy abscesses in various places, and pressing on the cord.

Dr. Whitman said that as he understood it, Dr. Lovett had not referred entirely to the œdema as the result of interference with the blood-supply, but to changes of the nutrition—caused by interference with the circulation—both of the blood and lymph.

Dr. Lovett explained that he had referred to an œdema, the existence of which had been established beyond question by microscopical examination. It has been accepted as a fact by all recent writers on pressure myelitis. To his mind it would be more capable of sudden changes than a chronic inflammatory condition, such as the older writers insisted upon.

Dr. Weigel asked regarding the use of the method under discussion in cases in which the external deformity was slight but the paralytic symptoms very pronounced. He had had a case of this kind in which the paralysis did not improve under recumbency and support, and death finally occurred. He had been surprised at the comparatively small amount of external deformity, but at the autopsy he had found complete destruction of the bodies of three or four vertebræ and an abscess extending the full length of the spine. In a case of this kind forcible correction might have led to sudden death; hence, it should serve as a warning of our inability to determine the internal condition in all such cases by the external manifestations.

Dr. Goldthwait said that the case reported by Dr. Gibney had interested him extremely. He had purposely refrained from offering any theory of the cause of the paralysis. To his mind, however, any of the conditions mentioned might be present and might be changed by a change of position—possibly a slight separation of the vertebræ. He had also intentionally avoided mentioning anything about the recession of the deformity. He had not seen a single case in which there had been a *permanent* recession, although there had often been a marked and immediate improvement. In many of the cases in which the deformity had not been broken up the patients stood better and were in better health, but disease had remained in the same situation. All that he had accomplished since then had been to change the compensatory curves. From our knowledge of the pathology of the

disease he did not think any *permanent* recession of the deformity was possible. These were not cases of forcible reduction, but those in which there had been gentle change of the deformity. All that he had seen had been relieved. The series reported comprised both severe and slight deformities. One of the cases was that of a woman, thirty-five years of age, with an excessive deformity that had existed for a number of years. As to the rapidity of improvement in the case mentioned, he did not believe it was a case of hysteria. Just as soon as she had been placed on the frame she had been able to move her limbs. The same had been true in several other cases, notably in a young man. He believed that the pressure having been relieved the circulation had been re-established just as in the case of laminectomy reported by Dr. Gibney.

Dr. McKenzie remarked that Dr. Goldthwait had just made the statement that he had not accomplished any change in the deformity, and yet he had asserted that he had relieved the pressure on the cord. He would like this apparent discrepancy explained.

Dr. Goldthwait replied that the pressure was relieved apparently by the improved position of the spine. The cases had been relieved, but the tracings showed that the seat of disease—the knuckle—had remained exactly the same.

OSTEO-ARTHRITIS OF THE SPINE: SPONDYLITIS DEFORMANS.

By JOEL E. GOLDTHWAIT, M.D.,
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The term osteo-arthritis is used to designate the disease of the articulations, which is characterized pathologically by a marked proliferation of the edges of the articular cartilage, associated with an atrophy or degeneration of the cartilage at the points of pressure, the two conditions producing an amount of impairment of function of the joint varying from the slightest inconvenience to complete ankylosis.

Various terms have been used to designate this condition, some of them suggestive of the general process, while others refer only to the local manifestation. Of the former, chronic rheumatism, arthritis deformans, rheumatoid arthritis, rheumatic gout, dry or proliferating arthritis, malum senile, arthrite sèche are the most commonly met with. Of the latter, the most common are malum coxæ senilis, referring to the disease as seen in the hip and spondylitis deformans, or spondylose rhizomelique, representing the same process involving the spine.

It is with reference to this latter manifestation of the disease that this paper is concerned, and while some mention of the general process is necessary, it will be only such as would be of value in considering the local disease.

The disease has been described by various writers in journal articles, but as yet there has been but slight mention of the subject in the works on orthopedic surgery, and most of the literature is devoted to the report of individual cases, with but little consideration of the disease itself. It is for this reason, and also because it seems to me, from my observation, that the disease is more com-

mon than has been supposed, that the subject is offered for discussion here.

Bradford,[1] in 1883, reported three cases of "rheumatism of the spine," all in men between thirty and thirty-six years of age. In two practically the whole spine was stiff, with ankylosis of the ribs. In the other the rigidity of the spine was confined to the dorsal region. In the first two cases there was a gonorrhœal history. In all of these cases the spine alone was affected.

Marie,[2] under the term spondylose rhizomelique, reports five cases of his own, in one of which there was a distinct gonorrhœal history. One patient was sixty years of age, the others from thirty to forty years, and in all some of the other joints—usually the hips or shoulders—were affected.

Strümpell[3] reports three cases, and in his book describes the type of painless progressive ossification of the spine and hips.

Mutterer[4] reports a case of a man fifty-eight years of age, with complete ankylosis of the spine, together with ankylosis of both hips and some slight trouble with the knees.

S. Popoff[5] reports a case of a man, twenty-eight years of age, in which the process developed very rapidly and was associated temporarily with weakness of the legs. This weakness disappeared as the disease became less active.

Beer[6] reports three cases, thirty-nine, forty-seven, and forty years of age. In one a history of gonorrhœa is given; in one the hips and shoulder-joints were affected; in another the shoulder and hand, and in one there is no mention of the other joints.

Marie and Astic[7] report a case of a man, sixty years of age, with trouble with the back of ten years' duration. The spine is completely ankylosed.

Bechterew[8] reports five cases: two women, about fifty years of age, in both of which about half the spine was rigid, with no other joints affected. Of the three men, one, a patient thirty-nine years

[1] Annals of Anatomy and Surgery, Brooklyn 1883, vol. vii. p. 6.
[2] Rev. de Méd., 1898, xviii, 285.
[3] Deutsche Zeitschrift f. Nervenhk., 1897, p. 338.
[4] Loc. cit., 1898, Bd. xiv., 1 und 2 Heft.
[5] Neurologisches Centralblatt, Jahrg., No. 7.
[6] Wein. med. Blätter., 1887, xx. 127 and 128.
[7] Presse Méd., 1897, October.
[8] Neurologisches Centralblatt, 1893, p. 426; Deutsche Zeitschrift f. Unfallhk, 1897, xi. 326.

of age, had the spine completely ankylosed, with the symptoms of nerve pressure, such as areas of anæsthesia and others of hyperæsthesia. Other joints were not affected. Of the other two, one had paralysis agitans and the other was insane. In both cases the spine was rigid, and there were symptoms suggestive of pressure upon the nerve-roots. The other joints were apparently not affected.

Individual cases are also reported by Fagge,[1] Spillman and Etienne,[2] Gasne,[3] Raymond,[4] Sänger,[5] Stocker,[6] Henle,[7] Baumler,[8] Davies and Colley,[9] Sturge,[10] and Pasteur.[11]

Of my own cases, ten in all, most of them have been seen in the Orthopedic Clinic (for adults) at the Carney Hospital, and the cases which have been selected are those which are particularly characteristic and in which the other joints have been but little if any involved.[12]

The first case was previously reported by me in the *Boston Medical and Surgical Journal* of December 26, 1895, and is here reported because of its relation to the other cases.

Case I. Mrs. McC., fifty-eight years of age, by occupation a nurse, had always been well and actively engaged in her work until the present sickness. Her family history is good, and she never had the least trouble from rheumatism. In July, 1893, she was caught in a thunder shower and her clothing was wet through. The next morning she complained of pain in the neck, with some tenderness in the upper part of the chest. There was no cough or expectoration. The pain in the neck increased in severity very rapidly, until the slightest motion caused the most intense suffering, and because of this she was admitted to the Good Samaritan Hospital. The patient entered the hospital in the service of Dr.

[1] Transactions Pathological Society, 1877, xxviii. p. 201.
[2] Rev. de Méd., 1898, xviii. p. 746.
[3] Sem. Med., 1899, p. 78.
[4] Loc. cit., 69.
[5] Neurologisches Centralblatt, 1898, xvii. p. 1144.
[6] Clinical Journal, May 9, 1894, p. 35.
[7] Vereinsbeilage S. deutschen med. Wochenschrift, 1894, S. 20.
[8] Deutsche Zeitschrift f. Nervenhk., 1898, xii.
[9] Transactions Pathological Society, 1855, p. 359.
[10] Transactions Clinical Society, 1879, xii. p. 204.
[11] Loc. cit., 1889, xxii. 298.
[12] The pathological specimens are from the Warren Museum at the Harvard Medical School.

Coolidge, and it was through his kindness that I was enabled to see her.

At the time of the first examination she was evidently suffering a good deal. The head was held a little to one side, the chin to the left, the shoulders drawn up, and all motions were most carefully guarded by muscular contraction. Any attempt at motion caused great pain. None of the other joints were in the least involved, and aside from this local condition the patient seemed well.

For the first week or two the patient was kept quiet in bed, and the various rheumatic remedies freely given with very little if any effect. After this a Thomas collar was applied for more complete fixation, and following this light-weight extension was used. These gave some relief, but neither could be used continuously, because of the nervousness of the patient; so that the two appliances were used alternately, each being worn for a few hours. In three or four weeks after the beginning of the attack a swelling appeared in the right side of the neck. This was about the size of a small lemon, and was apparently connected with the spine. At the same time the numbness of the left arm was noticed, with some impairment of motion, and this condition continued and increased until the arm was almost entirely helpless. The right arm and both legs also became involved, never in as marked a degree as the left arm, but enough to make motion in bed, unassisted, impossible. At one time there was difficulty in swallowing, and for a short period breathing was almost entirely diaphragmatic.

The patient's condition remained about the same for two months, after which there was a slow but steady improvement, so that at the end of the third month she was able to sit up for a short time each day, and in December, five months from the onset of the trouble, she was able to move about with but little assistance, and was taken home. The paralytic symptoms referred to in the right arm and legs had by this time practically disappeared, but the left arm was still very helpless. The swelling in the neck was practically the same as when first noticed.

The patient was not again seen until thirteen months later, during which time, aside from the Thomas collar, no special treatment had been carried out. At the time of this examination the improvement in the patient's general condition was most marked. She

moved about with perfect ease, and, aside from the stiffness of the neck and some impairment in the use of the left arm, she seemed well. Extension of the neck was entirely restricted, so that in order to raise the chin the whole body was bent backward. Rotation was also entirely restricted, while flexion was more free, it being possible to lower the chin to the chest. On each side of the neck, over the transverse processes, was very distinct thickening,

FIG. 1.

apparently bony in character. In the left arm all motions were limited, especially those in which the shoulder muscles were used. The fingers were flexed, apparently due to the contraction of the palmar fascia and the flexor tendons. The sensation of the hand and arm was normal.

At the present time the patient's condition is practically the same

as at the time of this last note. She is able to be about at her work, but there has been no change in the condition of the neck or arm.

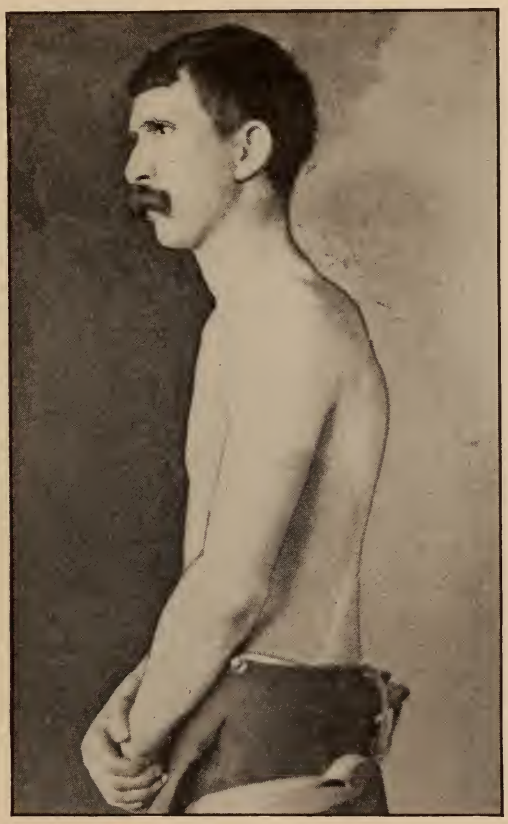
Case II. Mrs. M., seventy years of age, came to the Carney Hospital over two years ago. She had considered herself, and had been considered by her family, to be well until ten years ago. At that time she fell on the floor, striking the lower part of the spine. Since then she has had more or less pain in the back, and while previously she had carried herself quite erect, she gradually bent over both to the front and to the side. Except the spine, the joints were not affected. At the time of the examination there was a large, rounded kyphosis involving the whole dorsal and lumbar spine, together with quite marked lateral deformity. There was but little motion in the spine, and no symptoms of paralysis. Fig. 1 represents her condition at that time.

Case III. G. K., a man, twenty-one years of age, a steel polisher by occupation, came to the Carney Hospital in June, 1897. For one year he had been having trouble with the back, with a gradual loss of the use of the arms and legs. At the time of the first examination the whole spine was bent forward and was rigid. None of the other joints were involved. The left arm could not be raised to the head, and both legs were very weak. The knee reflexes were present, the left being exaggerated. There was marked muscular atrophy of both arms and legs. The patient was seen by Dr. Bullard, and the diagnosis of osteo-arthritis with pressure upon the nerve-roots confirmed.

Case IV. D. F., a man, twenty-nine years of age, an ordinary laborer, came to the Carney Hospital in September, 1897. Some years previous he had an attack of rheumatism when in Ireland, which lasted for three weeks. After that he came to this country, and for a time "fired" in an engine-room. He used "to sit in draughts to get cool." This brought on another attack of rheumatism, and he was unable to walk for seven weeks. The patient was well after the second attack of rheumatism until a few months ago, at which time he had typhoid fever. Soon after he was able to be about he noticed pain in the back, and as this increased and prevented him from working, he came to the hospital. At that

time the spine was straight except for a slight prominence of the eighth, ninth, and tenth dorsal spines. The motions of the whole spine were guarded, but those in which the low dorsal vertebræ were used were least free. A plaster-of-Paris jacket was applied, to prevent an increase of the deformity, and a little later this was

FIG. 2.



changed to a leather jacket, which has been worn until the present time. There has been some bending forward, as is shown in the photograph (Fig. 2), and his spine has gradually ankylosed, so that at present it moves as one piece from the pelvis to the lower part of the cervical region. The ribs have also become ankylosed, so that the respiration is entirely diaphragmatic. His general health

is good, and, except for an occasional few days of pain in the feet, the other parts of the body have not been involved.

Case V. P. B., a man, twenty-four years of age, came to the Carney Hospital in the early part of this year. His previous history was good, and there was no history of rheumatism in the

Fig. 3.

family. His work was that of a stationary engineer, having charge of a hoisting engine, and, being obliged to work in all kinds of weather, he was much exposed. Five years ago he noticed pain in the back and feet for a time, but has been regularly at work until the past year. Since then he has been so weak and tired so easily that he could not work. When seen at the hospital the

whole back was arched forward, as shown in Fig. 3, and there was complete ankylosis from the pelvis to the mid-cervical region. The ribs were also ankylosed, so that the breathing was wholly abdominal. The other joints were not involved and there were no signs of nerve pressure. The chief complaint was pain in the small of the back, due, undoubtedly, in part to the active disease and partly to the muscular fatigue resulting from the posture. For treatment, aside from general remedies, the patient has worn a light spring-steel brace with much benefit.

Case VI. J. S., a man, twenty-five years of age, came to the Carney Hospital in March of this year. For occupation he had done "firing" in a gas-house, and has considered himself well until the past three or four months, since which time he had had pain in the feet, followed by pain in the hands and spine. At the present time the whole spine from the pelvis to the mid-cervical region is rigid, and the ribs are also ankylosed, so that the breathing is wholly abdominal. A few small joints of the hands and feet are involved. The spine is fairly erect, there being but little of the anterior bending.

Case VII. G. H., a man, thirty-two years of age, consulted me in September, 1898, at the request of Dr. H. W. Cushing, of Johns Hopkins Hospital. The patient was a professor in one of our large universities. His family history was excellent; he had been well previous to January, 1897, when he broke down nervously. He went abroad, and soon after this stiffness of the neck and shoulders developed, not enough, however, to prevent his going about. Soon after this numbness developed in the left arm, with marked loss of power, and later the right arm was similarly involved, only not so severely. The condition improved slightly, and then remained about as it was at the time of the examination. At that time there was a moderate rounded curve involving the upper dorsal and cervical regions of the spine. This portion of the spine was rigid. The shoulders were drooped forward and there was marked atrophy of the muscles of the chest, shoulders, and upper back. Both shoulder-joints were somewhat involved, so that the motions were limited, and there was some thickening about the head of the humerus. On attempted motion there was

marked spasm of the muscles about the shoulders and upper spine. The legs were normal and there was no change in the reflexes. There was a distinct loss of power in the left arm, with some numbness, and there was a tendency to the same condition on the right side. The treatment, which has been almost wholly general, has been followed by improvement.

Case VIII. C. H., a man, sixty-two years of age, was referred to me by Dr. George Bancroft, of Natick, in April last. When in the Civil War the patient contracted "rheumatism," and the back has been stiff ever since, so that he has not been able to work regularly. The neck has not been involved until the past eight months, previous to which time he overworked and broke down. Since this time the neck has been painful and has been growing worse. When examind the whole lumbar and dorsal spine was ankylosed and free from pain. The cervical region could be moved but slightly, and this only with great pain. Even the atlas and axis were apparently involved, there being but a very few degrees of motion of the head in any direction. The ribs moved slightly on respiration. The sensation in the right arm was much impaired, but the muscular strength remained about the same as the other side. The other joints were not involved. A Thomas collar, to support the head, gave very marked relief in this case.

Apparently in this case there have been two separate attacks of the disease—one early in life and the other one thirty years later.

Case IX. M. J. K., a man, thirty-four years of age, by occupation a currier, was seen by me at the Massachusetts General Hospital with Dr. John Homans. The patient had been well previous to five years ago; at that time he had an attack of pain in the shoulder, the left knee, and the right foot. Soon after this he noticed that his back was somewhat stiff. Three years ago the pain became acute in the right heel, and since then this has caused him the most trouble. One year ago he had another attack of the so-called rheumatism, in which the neck was affected. He was in bed at that time for six months, and since then the back has been much stiffer, and it has been difficult for him to breathe freely.

When seen by me he was well nourished and developed. The spine was straight, and was ankylosed from the pelvis to the

cervical region. The ribs moved but slightly with respiration, the breathing being almost entirely abdominal. The other joints were in fairly good condition, except the right heel, which was

FIG. 4.

painful, and the X-ray picture showed a similar osteo-arthritic process. The position of the spine is shown in Fig. 4, and is interesting as showing that the rounded back is not necessarily characteristic of the disease.

Case X. Mary S., thirty-five years of age, came to the Carney Hospital about three years ago because of trouble with the back and neck. The history as given was that a few months previously she made a change in the underclothing and took cold. This was followed by a sudden pain in the neck, which prevented her from being about. At that time the slightest motion of the head was extremely painful. No other joints were involved. The arms for some time could not be used freely, the left one being worse. Under general treatment the patient gradually improved, so that at the present time, except for the rigidity of the upper dorsal and lower half of the cervical spine, she is well.

In all about thirty-five cases have been reported previously, or forty-five cases, including the ten of my own. Beside this there have been several reports of pathological specimens, illustrating the pathological appearance of the disease entirely apart from the clinical history.

In analyzing such a series of cases certain facts are at once suggested, but before they can be studied to much advantage they must be distinctly differentiated from the other type of rheumatoid disease, which is chronic in character and also leads to joint ankylosis, but in which there is atrophy of all the joint structures, with no tendency to nodular growth or osseous deposit, as is seen in the type of disease under consideration.

Both of these diseases are usually considered together in the text-books under the head of arthritis deformans, which accounts for the variation in the clinical picture as it is presented by the various writers.

As the cases are seen side by side there cannot be the slightest question but that there are two distinct diseases or two very widely divergent types of the same disease, and it is because of this that much of the confusion has arisen.

In a paper published in the *British Medical Journal*, Bannantyne and Vollman have carefully described the two types, and in a paper entitled the "Treatment of Joints Disabled by the So-called Rheumatoid Diseases," published by the writer in the *Boston Medical and Surgical Journal*, January 29, 1897, the two types were described and illustrated. In that paper the descriptive term

"arthritis deformans" was used to designate the whole class of these so-called rheumatoid diseases. Rheumatoid arthritis was used to designate the cases in which joint inflammation and atrophy, resulting in ankylosis and marked distortion, were the chief features, while osteo-arthritis was the term used for the cases in which the nodular deposits about the articulations were the most prominent features.

The importance of this differentiation is mentioned because several of the cases which have been published as spondylitis deformans are undoubtedly cases of rheumatoid arthritis, and are not osteo-arthritis, which explains the discrepancy in the clinical picture.

It is evident, in the first place, in the analysis of the cases, that the disease is essentially a disease of adult life, but not necessarily a disease of old age, as is often stated. Some of the worst cases have developed in the period of late adolescence, while in very few has the process started in old age. The disease as it is seen in old age is not so definitely localized in the spine, but, as a rule, the other joints are more or less involved.

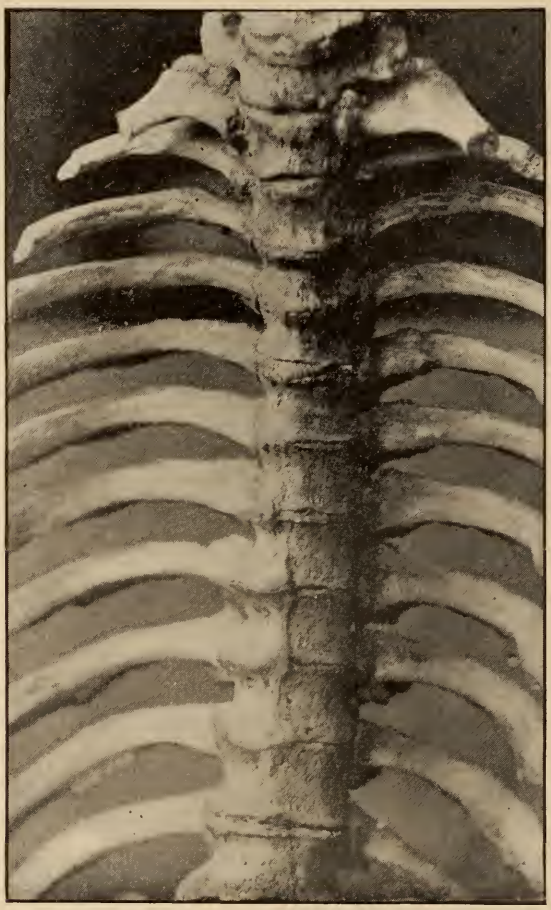
Another feature which is also noticeable is that there is no one cause of definitely recognized etiology to explain the onset. Gonorrhœa has been mentioned as a probable cause in a certain number of instances, but in a much larger number this is not suggested as a possibility. In the majority of cases the cause seems to be some exposure or the rapid change in temperature of the affected part. These influences are recognized and accepted as etiological factors in similar phenomena in other parts of the body, and their importance in spondylitis deformans is probably equally certain. Exposure to wet or cold, or occupations which necessitate sudden changes from heat to cold, such as "firing" or "engineering," are the causes most frequently met with. Bechterew suggests trauma and heredity as possible causes. Beucke believes the process to be due to senile and mechanical causes.

Most of the other writers, however, either do not express an opinion as to etiology or else accept exposure and gonorrhœa as most probable.

Still another thing which is evident is that the disease is not peculiar to this generation, and that it also is not peculiar to the

human race. Bland Sutton reports a specimen illustrating this disease in a mummy taken from the pyramids, while Sutton reports the disease in oxen and horses, and Bricon mentions a similar condition in cats.

Fig. 5.



Pathologically, the disease consists of a nodular enlargement of the edges of the articular cartilages, with the subsequent ossification of these nodes and an extension of the process into the ligaments which have their origin or insertion near by. With this hypertrophy at the edges of the cartilage the centres or areas of pressure

usually undergo atrophy. In the atrophy the interstitial tissue is the last to be absorbed, which explains the granular appearance as it is seen at times; but as the process continues this interstitial

FIG. 6.

substance is absorbed, and either the two surfaces of bone fuse or remain in apposition. In the other joints in which there is free motion the bare surfaces of bone frequently become polished and increased in density.

The process in the spine usually begins upon one side anteriorly and extends up or down along the anterior lateral ligament. It may remain as a comparatively local process involving only a small portion of the ligament, as is shown in Figs. 5 and 6, or it may cross over to the other side and extend up and down until the whole spine is invaded. When this occurs the chief deposit or new formation of bone is along the lateral ligament, the change in the median line consisting simply of a fusion of the vertebræ, as shown in Fig. 7 and also in Fig. 8, in which the lumbar spine had become joined to the sacrum.

FIG. 7.

At times, even though the hypertrophic change is quite active, that which develops from adjoining vertebræ does not fuse, and a more or less free joint remains. This is distinctly shown in Fig. 7 and also in Fig. 9, in which an intermediate joint remains mobile (*a*), even though the osseous deposit has been so extensive as to entirely overlap the articulation in front (*b*).

As the disease goes on in the ligaments and cartilages the intervertebral substances atrophy, and if the process is slow the entire intervertebral disk may be absorbed before ankylosis takes place.

If this be the case, naturally the back is rounded and the spine becomes very much arched, as shown in Fig. 10. If, on the other hand, the process is more active the vertebræ may become ankylosed before the disk has been absorbed, and, consequently, no deformity is produced. If this be the case the disk ultimately is replaced

FIG. 8.

by osseous tissue and the ankylosis rendered more complete. The condition is shown in Fig. 9. If the process is more active on one side than the other it is easy to see that lateral deformities may result, and, naturally, this is more commonly seen in the cervical region, where the spine has more flexibility. The condition is well shown in Fig. 11.

While these changes are taking place in the anterior portion of the spine, similar changes take place in the ligaments and articula-

FIG. 9.

b *a*

tions at the back, so that the transverse and rarely the spinous processes are affected. It is the disease in these regions that causes

FIG. 10. FIG. 11.

most of the symptoms of paralysis or disturbed sensation, by narrowing the foramina through which the spinal nerves pass.

Clinically, as the disease is seen, the subjective symptoms are usually slight in comparison to the actual pathological change, and frequently there has been so little trouble with the back, and the change has taken place so gradually, that the patient is not conscious of any special limitation, the condition being discovered by accident. More often, however, there is considerable pain, which is referred to the back, and which is aggravated by change of position. When quiet the pain is so much relieved that the patient frequently does not seek treatment until the disease is far advanced, or even if treatment is asked, it is often excused without examination as a "touch of rheumatism," and the therapeutic suggestions made accordingly.

If the disease is seen early, before much actual change has taken place, there is usually a definite region in the spine to which the pain is referred, and in this region the motions are restricted, at first, of course, by muscular spasm, but later by osseous change. At this time, when the process is so definitely localized, the portion of the spine affected may appear more prominent than normal, suggesting the beginning deformity of Pott's disease, and at this time a positive diagnosis may not be possible. The onset is suggestive, and also the reference of the pain to the back at the exact seat of the disease rather than the referred or abdominal pain of Pott's disease, but it may require some weeks before the true nature of the process can be determined. Case IV. was at first thought to have Pott's disease, and it was only after seeing him several times that the correct diagnosis was made.

As the ankylosis of the spine takes place the ribs almost invariably are affected, and the process may prove so extensive that all the articulations become ankylosed, and the thorax is perfectly rigid. In this case thoracic respiration is, of course, entirely lost and the breathing is done wholly by the diaphragm.

Beside the pain in the back and the limitation of motion, neuralgic pains in the arms or legs, together with disturbances of sensation, numbness or hyperæsthesia, are probably the most common symptoms. These are, of course, due to pressure upon the nerve roots, and, consequently, are not seen until the disease is well advanced, or when the onset has been unusually rapid, as in Case I. Following these neuralgic pains, when the disease is well

advanced paralysis may result, the extent of which varies from complete inability to use the part to a slight inconvenience. Rarely are the two sides affected equally, or if both sides are affected the symptoms have developed at different times. This, together with the fact that the paralysis is peripheral in type, is of importance in differentiating it from Pott's paraplegia.

Occasionally, when the disease is very active, the same osseous deposit takes place in the posterior ligament (*ligamentum longitudinum posticum*), and may result in enough narrowing of the spinal canal to produce symptoms of pressure paralysis exactly similar to that seen in connection with Pott's disease. This is not very common, but nevertheless does occur, and must be borne in mind in making the diagnosis. Case I. had this type of paralysis in connection with the paralysis of the arms, due to the pressure upon the nerve-roots. The presence of the two types of paralysis is of assistance in determining the diagnosis.

After the active stage of the disease has passed, with the lessened vascularity and natural shrinking of the non-osseous structures, the direct pressure upon the spinal cord is usually relieved, and the same may be true of the pressure upon the nerve-roots. In my own experience, and, so far as I can learn, from the reported cases, there is no case in which the symptoms due to the direct pressure upon the cord have not been relieved. With the involvement of the nerve-roots, while there has always been some improvement, in many of the cases the recovery was never complete.

The deformity, which is so striking at times, has a wide range of variation. In the most extreme form the rounded back with the protruded head and the flat chest (Fig. 3) is the type usually pictured or described. It is evident, however, that the nature or extent of the deformity must vary with the seat or extent of the disease, and also with the rapidity of its development. In Case IX., Fig. 4, the whole dorsal and lumbar spine is ankylosed, with scarcely any change in the normal curves.

The lateral deformity of such an extreme type as is shown in Fig. 1 is rarely seen, and probably could only occur late in life. It is probably due to osseous deposit and thickening on one side of the spine, with atrophy and softening on the other. A moderate amount of lateral deformity is not uncommon, and

is almost always present when the disease is in the cervical region.

The treatment of this disease is of more importance than is commonly supposed, and is partly medicinal and partly mechanical. As an early diagnosis is, of course, of the first importance, it is at this time, before the deformity has taken place, that the most can be accomplished. The disease is probably a trophic process, and, consequently, all medicines or methods of treatment which debilitate should be most carefully avoided. This naturally includes the various so-called rheumatic remedies, all of which are depressants, and also the various baths or courses of treatment which tend to lower the vitality. The general treatment should be wholly nourishing and stimulating. Extra diet, stimulating bathing, massage of the unaffected parts, electricity in a mild current, all are of value, and also the dry heat, provided it is not used so frequently as to be debilitating, relieves the pain and does much good. For medicines, iron, arsenic, and strychnine are the drugs which are of the greatest value. Cod-liver oil and alcohol in medicinal doses are also useful. For mechanical treatment some form of spinal support should be used at once, partly to relieve the pain by restricting the motion and partly to prevent the marked deformity from developing. Case IV. was under treatment quite early in the disease, and, even with the imperfect general care which it was possible for him to have, he has been kept from becoming more deformed than is shown in his picture (Fig. 2). A plaster-of-Paris jacket was used at first, and this was followed by a leather jacket, which is still worn. The whole spine has been involved and also the articulations with the ribs, and I am sure that without treatment the deformity would have been as great as that shown in Fig. 3. The position of the chest, with the greater room for respiration, has had a very definite beneficial effect upon his general health.

Manipulation of the spine is naturally of little value, and probably would result in more harm than good. Attempts have been made to forcibly break up the ankylosis,[1] but they have been followed, as would be expected, by results which were not satisfactory.

[1] Strümpell. Deutsche Zeitschrift f. Nervenhk., 1897, xi. p. 338.

DISCUSSION.

Dr. Gibney said that as far back as 1881 his attention had been called to this subject in an article by a writer who had observed quite a number of these cases treated at some baths in France. Dr. Gibney said that at that time he had been objecting to the use of the term "tuberculosis." Since then he had seen quite a large number of cases of spondylitis deformans; they were quite distinct from the destructive and tubercular form. He had met with very few such cases in young persons. On May 15th he had seen in consultation a lady of sixty-four years, who, it was said, Dr. Ridlon had attended in 1893. When seen she was doubled over, and was breathing with some difficulty, although her son assured him that in 1884 his mother had been absolutely straight. In 1893, according to the history, no brace had been applied by Dr. Ridlon. In 1896 she had had two or three months of complete paraplegia without any sensory disturbance, and had recovered from this spontaneously. In the last year and a half she had been growing very much worse, and at present there was a marked antero-posterior curvature with a good deal of lateral deviation. There were distinct bony processes with lateral masses; the knees showed the presence of some osteophytes, and her ribs overlapped the pelvis. The disease had existed for about ten years. From our knowledge of its pathology it was evident that rheumatic remedies could not have any effect. He also favored a stimulating medicinal treatment. There was very little to be accomplished by mechanical treatment except as a supporting measure.

Dr. Ridlon said that he did not recall the case just mentioned. One year ago a woman of about twenty-five years had come to him with very great posterior curvature, and some lateral curvature to the right. The entire dorsal region and over half of the lumbar region formed one great stiff curve. She was completely bent over. She came from a nervous and eccentric family. The spinal curvature had existed for about two years, and had been steadily increasing. He had been inclined to look upon it as a hysterical spine. She was sent to the hospital and anæsthetized, but under complete

anæsthesia the spine had not yielded at all, so that he had been forced to the conclusion that it was a rheumatic spine. Forcible manipulation produced a marked crackling, and it straightened out as far as the upper dorsal region. He had then put her up in plaster, and she had had no bad symptoms. After two weeks he had removed the plaster and applied a spinal brace, and had begun a course of vigorous exercises. Her general condition had very greatly improved. At first there had been very little chest expansion; now, it was very fair for a woman. The lower portion of the spine at present had about half the normal motion for a person of her age. Whether this forcible treatment would be justified in any large number of cases he was unable to say; he had tried it as an experiment upon a patient who was willing to take almost any chance.

Dr. Whitman said that the severe postural curvatures of the spine sometimes seen in adolescents might be confounded with the cases reported in the paper. It was in this class that he would place the last speaker's case.

Dr. Starr, of Toronto, said that we should eliminate the rheumatic class from the cases spoken of specially in the paper. Dr. Ridlon's case might have been one of true rheumatic arthritis not involving the bony structures. He had under his care at present a man of forty years who had served in a military campaign in India, and now had a disease of the spine of ten years' standing. There was a marked antero-posterior curvature. He had had no paralysis, but neuralgic symptoms affecting the arms, and had sought relief solely because of the feeling of weariness brought on by the effort to maintain the erect position, which necessitated a bending of the knees. One interesting feature of the case was that while the ribs were ankylosed with the spine the man could still pursue his occupation of playing a clarionet in a band.

Dr. Taylor said that he had seen two classes of rheumatoid spines. One class occurred in young people in whom, as a rule, not much deformity was present, but marked stiffness of the spine. These cases were apt to occur in the upper part of the spinal column, and could be greatly relieved by head support. The other class of

cases was represented in the series of photographs exhibited by Dr. Goldthwait. He had a good pathological specimen from such a case which he would be pleased to show the members. The affection might be confined to the spine or ribs, or might involve most of the other joints of the body. Dr. Goldthwait had shown that lateral curvature might accompany this condition, thus adding another to the long list of affections, which should be borne in mind as sometimes associated with scoliosis.

Dr. Goldthwait, in closing the discussion, said that mechanical treatment could only steady the parts and make the patient more comfortable, but even this had been found quite desirable. Forcible manipulation had been tried. Strümpell had reported a case of true osteo-arthritis in which he had attempted manipulation without any benefit. Dr. Ridlon's case was hard to classify, and was certainly very interesting. As to the occupation deformities, it did not seem to him difficult, as a rule, to differentiate them. The cases of Dr. Taylor might have been rheumatic, or due to occupation.

REPORT OF A CASE OF SPONTANEOUS DISLOCATION OF THE HIP OCCURRING DURING THE COURSE OF AN ACUTE OSTEOMYELITIS OF THE NECK AND SHAFT OF THE FEMUR.

By WILLIAM J. TAYLOR, M.D.,
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In January last, a boy, aged sixteen years, came under my care with the following history: Both personal and family history was absolutely negative, for he had never been ill, not even the ordinary diseases of childhood, and was always strong, hearty, and well.

In October, 1898, while playing football he slipped and fell, striking the right hip. This was on Saturday, and he got up and walked about without any special discomfort until the following Monday, when he began to have pain and discomfort in the hip, and shortly after went to bed. He was seen by Dr. George H. Stroup, of Eddington, a very careful and painstaking physician, who put him in bed, with simple external applications to the hip, as at that time there was no evidence of dislocation or of any special damage to the joint —nothing but pain. The pain continued and his condition had not improved at all in several weeks. Dr. Stroup concluded that he had beginning hip-joint disease. Repeated examinations of the hip did not show any difference in the length of the limb or in the position of the head of the bone.

He was admitted to St. Agnes' Hospital at the end of November, 1898, where he was treated with a weight and pulley extension apparatus, on the supposition that he had ordinary hip-joint disease. Just when the present condition of the hip occurred it is not accurately known, but about a week or so before I saw him he had been etherized and a large abscess opened over the upper and outer aspect of

the thigh. This had drained freely for a time, but was closing up, and eventually became a small granulating wound.

When I first saw him, about January 12, 1899, he was in a very weakened and prostrated condition, pale, anæmic, with a very weak, rapid, and intermittent pulse and high temperature. His right limb was lying in a position typical of dorsal dislocation of the hip, and was very much shortened and the knee adducted. A line drawn from the anterior superior iliac spine to the tuberosity of the ischium showed that the head of the bone was dislocated upon the dorsum of the ilium, and there was unquestionably destruction of the neck of the bone, and, possibly, a part of the great trochanter. His general condition was so bad that I waited some little time to enable heart stimulants to have some effect.

Finally, he was etherized and an incision made over the hip, when it was found that the whole neck of the femur and part of the greater trochanter had been destroyed by an acute osteomyelitis, which involved also the outer surface of the acetabulum. The head of the bone was dislocated upon the dorsum of the ilium, and it was, therefore, a true spontaneous dislocation and not the so-called pathological dislocation due to the absorption of the head and neck of the bone. There was central osteomyelitis extending well down the shaft of the femur, with the periosteum detached and numerous abscesses which burrowed here and there along the tissues of the thigh. All of the diseased bone was cut away, as well as about four inches of the shaft of the femur, which showed evidences of disease, the medullary cavity was scraped out as far as could be reached and then packed with iodoform gauze. The head of the bone was removed from its new position upon the dorsum of the ilium and the tissues thoroughly curetted in every direction. Before, however, this could be done as thoroughly as was desired, his general condition became so alarming that I was obliged to abruptly stop the operation. Intracellular injections of saline solutions, with whiskey, strychnine, digitalis, and hot coffee by the rectum, as well as external heat, were employed. He gradually reacted, when a weight and pulley extension was put upon the leg and an external splint. I should have said that no attempt was made at closure of the wound, which was packed with iodoform gauze.

The progress of the case was absolutely uninterrupted by any

mishap. He gained in strength and in color steadily, his appetite improved, his pain ceased at once, and he made a very rapid and complete recovery.

There was, of course, a marked difference in the length of the two limbs—some four inches—but when he left the hospital he was able to walk on the affected limb without discomfort and with excellent movements of the thigh in all directions, the new joint being freely movable.

The specimens of bone removed, which I had hoped to have here, show clearly the nature of the diseased process. Dr. George A. Muehleck, pathologist to the hospital, reported that "The pathological changes found are typical of osteomyelitis. The process has probably been of some duration, because it presents considerable atrophic formation."

Clearly, we had here an osteomyelitis of the neck and great trochanter of the femur, directly produced by the injury. During the course of the disease a subacute synovitis developed either by extension from the focus of infection or directly as a result of the violence done at the time of the fall, with a gradual distention of the capsular ligament, just as we see it occur occasionally in typhoid fever.

I regret very much that it was not possible to have taken cultures of the synovial fluid before the formation of the abscess, nor to determine the exact time at which the hip was dislocated. The distention of the capsular ligament was undoubtedly slow, with elongation of the ligaments of the hip, and probably this elongation was more pronounced posteriorly than anteriorly, where the Y-ligament gives greater resistance.

The pathological processes evidently started as epiphysitis in the soft, rapidly growing tissues at the line of junction of the head and neck of the femur, which line is included within the synovial membrane. The process was sufficiently slow to excite a synovitis with large outpouring of the fluid, which thus lifted the head of the bone out of its bed in the acetabulum and permitted the head of the bone to slip upward and backward upon the dorsum of the ilium before the neck was destroyed by the infective process. Whether this fluid was synovia infected by micro-organisms, as it must necessarily have been infected, or true pus is merely conjecture, but probably the

former. This is exactly similar in mechanism to the dislocation of the femur which occurs in typhoid fever.

It would hardly have been possible to have replaced the head of the bone in its normal relations, even if the condition had been recognized, as the infectious degeneration of the bone was so extensive that any manipulations would most likely have fractured the neck; but it is quite conceivable that the distention of the capsule might have been recognized prior to the occurrence of the dislocation, and the excessive amount of fluid drawn off either by an aspirator or free incision and drainage.

The mechanism of spontaneous dislocation of the femur upon the dorsum of the ilium has been very carefully studied in connection with typhoid fever, the various eruptive fevers, and rheumatism, and in my paper read at Buffalo, in 1896 (*Transactions of the American Orthopedic Association*, 1896), the literature of the subject was very thoroughly gone over. It is, therefore, only necessary to mention the experiments of Bonnet and Parise, which show that by the forcible injection of fluids into the capsule of the hip-joint the articular surfaces can be separated for a distance of from one-eighth to one-quarter of an inch, that the distention causes the limb to become flexed, which relaxes the Y-ligament. With the capsule filled with fluid, the head of the femur can leave the cotyloid cavity without creating a vacuum, for the ligament takes its place, and thus a great obstacle to dislocation, atmospheric pressure, is removed.

Dr. Roswell Park (*Medical Record*, November 2, 1895), in discussing the general subject of dislocation occurring in cases of osteomyelitis, mentions that they may be produced by muscular spasm alone, by destruction of the ligaments and removal of opposition to displacement, or by epiphyseal separations, which sometimes occur in connection with acute cases of pyogenic type.

In a personal letter, he states that he has seen two or three cases of dislocation of the hip due to acute osteomyelitis of the head and neck of the femur, and in one of them the dislocation occurred during a short railway journey, when the child was being brought to see him.

It would, therefore, seem wise in all cases of acute inflammation of joints of infectious origin, when the capsule is distended, to aspirate and draw off the excess of fluid. This will accomplish two things—it relieves the distention and pain and prevents the possibility of dis-

location, which latter, we must admit, is not of frequent occurrence, and it will enable us to make cultures of the fluid from within the joint—a very valuable aid in diagnosis, for if pyogenic micro-organisms be found the joint can be freely opened and drained.

I am convinced that in many of the acute inflammatory processes the duration of the disease may in this way be materially shortened, while by drilling the trochanter and neck, and making an opening in the bone sufficiently large for disinfection and drainage, much good may be accomplished.

Had the true nature of the condition, an acute infectious osteo-myelitis, been appreciated earlier in the disease, it is probable that much of the subsequent destruction of the tissues might have been prevented by free incision into the joints, trephining the trochanter and neck of the bone, and curetting away all the necrotic tissue, with disinfection of the cavity and provision for thorough drainage.

At the time he was first seen by me an opening had already been made in the tissues of the thigh and hip which drained freely; his general condition was very bad, the pulse weak and intermittent, and general evidences of septic infection. I therefore hesitated to institute radical measures until by judicious stimulation his powers of resisting the shock of a prolonged operation should be improved. During the operation the greatest haste was necessary, for the loss of blood was very great, and, indeed, it could not be completed with the thoroughness I should have liked, for fear he would die on the table. Intracellular injections of large amounts of normal salt solution undoubtedly saved his life.

In the treatment of synovitis of the hip-joint from whatever cause, if there be pronounced effusion, it is essential that the limb be kept in a straight position by some form of extension apparatus and the foot slightly everted. In this way contraction of the muscles and adduction are prevented, and there is less intra-articular pressure and consequent stretching of the ligaments.

DISCUSSION.

Dr. Thorndike asked if the process had been limited to one side or the other of the epiphyseal line.

Dr. Taylor replied that both sides had been destroyed.

CONGENITAL DISLOCATION OF THE HIP.

By HARRY M. SHERMAN, M.D.,
SAN FRANCISCO.

The series of cases here reported represents all the work I have done in the way of endeavoring to relieve the condition.

Of the Lorenz open operations—the "bloody" method—there have been nine, and all of these were operated upon more than two years ago.

In the operations I copied as closely as possible Lorenz's technique, using his instruments where special instruments were required. In no case is there anything special to note about the healing, nor was there any departure from the plan of Lorenz in the after-treatment, except the non-use of massage in all but one case. Massage was not used because I could not supply it in the hospital, and as I noticed that the first case operated upon developed her motion without it, I rated the treatment as of less value than it may be. Still, it is generally true that children who are at all active do not need massage to work a joint loose, provided its immobility is not due to a pathological process or to the result of one.

Of the nine operations, in three the reduction is stable, but the joints are ankylosed. In one the reduction is stable and there is good motion and good function, and this is the case that developed its motion spontaneously. In one the reduction is stable and there is good motion, but in this case successive "brisements" of the joint were needed to prevent ankylosis, and in this case massage and passive motion were practised for a long time. In both of these cases there has been some shortening of the limb. Three hips have become reluxated. In one case definite reposition was not accomplished; this patient died of pneumonia about forty-eight hours after the operation, and this was the only death.

In all these cases the hips had definite and measurable motion when they were first taken from the splints, and the ultimate anky-

losis developed while the limb was in use. This ankylosis must be due to adhesions between the femoral head and the acetabulum, which occur during the repair of the injury done the floor by enlarging the acetabulum. Access to the joint is had with so little damage to ligaments and muscles that the cause of the ankylosis cannot lie in them. In cases of this operation early and repeated manipulations of the joint under an anæsthetic, these manipulations to be followed by massage and passive motions, may be necessary to prevent ankylosis.

Reluxation must be due to imperfections in the size and shape of the acetabulum, both absolutely and also relatively to the femoral head. If the parts are not properly adapted to each other the absorption of the plastic matter thrown out in the process of repair, which certainly binds the bones together in the first few weeks after operation, opens the way to reluxation from slight causes.

There have been thirteen joints reduced by the Lorenz manipulative method—the "bloodless" method—and all of these were done over one year ago. In no case have I found the manipulation difficult, except in one instance where the reduction was impossible.

Of the thirteen operations, eleven were primary and two were secondary, being re-reductions after reluxations. Of the thirteen reductions, one is stable and has good motion, but as the child has developed a vertebral tuberculosis—for which it is being treated by recumbency on a frame—the exact utility of the joint cannot be stated. From the beginning it was the most satisfactory of all the cases. One is supposedly stable and has useful motion, but the statement is made on the authority of the mother, the child being at home in Nevada. One is stable, but is ankylosed, the ankylosis being the result of suppuration following an exploratory incision made under the mistaken belief, as it turned out, that reduction had not been accomplished. One case became immediately reluxated, and this plan of treatment was abandoned. Seven of the joints became reluxated, some during the wearing of the splint and others very shortly afterward. In one case the final result is unknown, because of the impossibility of finding the child. And in one instance, as has been mentioned, reduction was impossible.

In these cases it was comparatively easy to put the femoral head

on the acetabulum, but I could not in any case be sure that it was definitely *in* the acetabulum and in contact with the floor of the socket. In all instances the femoral head was, after reduction, too obviously palpable, even though it was in the exactly proper location as regards the iliac spine and the pubic spine, and the trochanter tip was on Nélaton's line. The length of time for the wearing of splints did not seem to affect the tendency to reluxation, one case having worn splints for nearly a year, and having suffered reluxation while wearing the last splint.

In order to be sure that the femoral head was definitely *in* the acetabulum, with no interposing tissue between the bones, I began to make the reduction through the original Lorenz incision. To prevent possible shortening of the limb and almost certain ankylosis I did not enlarge the acetabulum. So as to make the reduction as stable as possible and take up the redundant tissue I overlapped the edges of the incision in the capsule and stitched them so overlapped. In each instance where this was done I thought, from the exploration and inspection of the parts, that I had a practical acetabulum and a practical femoral head. If this was so it merely needed their being put in the proper relation to each other to win success. There have been ten hips treated by this method, eight of the operations being primary and two secondary, because of reluxation after this very plan of operation. All of these have been done in the past fifteen months. In two cases the reposition is stable and the joints are satisfactory, though the radiographs do not show that perfectly normal relations have been established between the femur and pelvis.

Four hips definitely reluxated, and of these two were cases submitted to the secondary operations. Four hips are still in splints, the reductions up to this time being stable, and of these two are again those submitted to secondary operation.

It is evident that my idea of a practical acetabulum, as I got it from the finger exploration, was not accurate. Perhaps my idea of a practical femoral head was also wrong. By the term practical I mean a part not normal in shape or size, but not so misshapen or small as to be impossible of use. But I know that the luxations were reduced, and reluxation could only have occurred because of the malformation of the parts and their maladaptation to each other.

UNUSUAL DEFORMITY FOLLOWING OPERATION FOR KNOCK-KNEE.

By W. R. TOWNSEND, M.D.,
NEW YORK.

Dr. Townsend presented a girl patient, aged thirteen years, who stated that she was operated upon in her early life for knock-

Fig. 1.

knee, and the records of the institution that she was operated in show that a supracondyloid osteotomy was done on both legs, and that they became infected and the knee-joints became involved, and some necrosis of the lower end of the femora followed. She

FIG. 2.

has had no treatment since that date, which was some time in her third year. The patient is a well-nourished, strong, healthy girl. Lying on her back the thigh is adducted, the leg in outward rotation and resting on the external malleolus, the toes pointing away from the other limb. With the knees touching, the heels are four-

The X-ray picture shows that the lower fragment of the femur has united at almost a right angle, and is markedly rotated.

teen and a half inches apart; with the thigh in normal position the foot can be moved around, so as to be parallel with its fellow; with the thigh flexed and adducted, it can be made to point to the front, otherwise it points to the back. The right femur is six and a half inches long; the left, fifteen inches. The right leg, thirteen inches; the left leg, sixteen inches. In standing on the left leg the right leg is held hyperextended and rotated outward, and the heel points toward the toe of the left foot. In standing with the feet on the ground the left knee is bent, and the right foot is placed at right angles to the other foot. Motion in the right knee-joint is limited; in the left, perfect. The popliteal space is to the front and outer side, and the patella is on the outer and posterior surface of the limb. There are two cicatrices, showing the old operation wounds.

ENLARGEMENT OF TIBIAL TUBERCLES. TWO CASES.

By HENRY LING TAYLOR, M.D.,
NEW YORK.

Case I. Acute inflammation of tibial tubercles. This boy, aged twelve years, was first seen at the Hospital for Ruptured and Crip-

Fig. 1.

pled, Out-patient Department, May 3, 1899. Without injury or other known cause the left tibial tubercle had begun to swell and

become painful about one week before; three or four days after the right became similarly affected. Examination showed both tibial tubercles enlarged and tender, the left more than the right. The swelling was hard, and appeared to be bony or periosteal. Local applications of Churchill's tincture of iodine were followed by prompt and decided improvement, and the swelling is at present moderate and the tenderness slight.

Case II. Inflammation of bursa over tibial tubercle with involvement of the subjacent tubercle. This lad, sixteen years of age, was first seen at the Out-patient Department of the Hospital for the

Fig. 2.

Ruptured and Crippled, May 10, 1899. Eight months previously he had fallen, striking below his right knee. Enlargement of the right tibial tubercle soon followed and still persists, though the swell-

ing is now smaller than formerly. Examination showed a well-defined swelling about one inch in diameter over right tibial tubercle, where there was some tenderness and indistinct fluctuation or elasticity over a hard base. Under the local application of Churchill's tincture of iodine there has been marked improvement.

In the last three years I have seen several cases of enlargement of the tibial tubercles; the swelling usually came on without known cause. In one or two cases the swelling had lasted a considerable time, and at the time of examination was not sensitive, seemingly a permanent bony enlargement due to previous inflammation. The patients shown will serve to call attention to affections at this point, which appear to have attracted little notice. The pathology evidently differs in different cases, as in the two shown, but seems to be an osteitis or periostitis, which, as in the second case, may be of traumatic origin, or secondary to a bursitis. This pretibial bursa is said to be inconstant. The tubercle is developed on a lip of the epiphysis, and its proximity to the actively proliferating emphyseal line may render it specially sensitive to traumatic or other irritation.

DISCUSSION.

Dr. Ridlon said that the same thing had occurred in his oldest son, coming on first as a bursitis and terminating in enlargement of the tubercle.

Dr. R. H. Sayre said that he had seen this in hurdle racers, and had attributed it to the strain exciting a periostitis.

Dr. Townsend said that he had seen the same thing in a runner at college, and had met with several such cases in dispensary work. He had excluded syphilis in these cases.

Dr. W. J. Taylor said he had seen it twice in high jumpers.

Dr. A. R. Shands, of Washington, D. C., said that he had a case, at present under his care, in a boy attending a military school and having athletic proclivities.

PARTIAL LUXATION OF THE HUMERUS FOLLOWING ACUTE ANTERIOR POLIOMYELITIS.

By J. HILTON WATERMAN, M.D.,
NEW YORK.

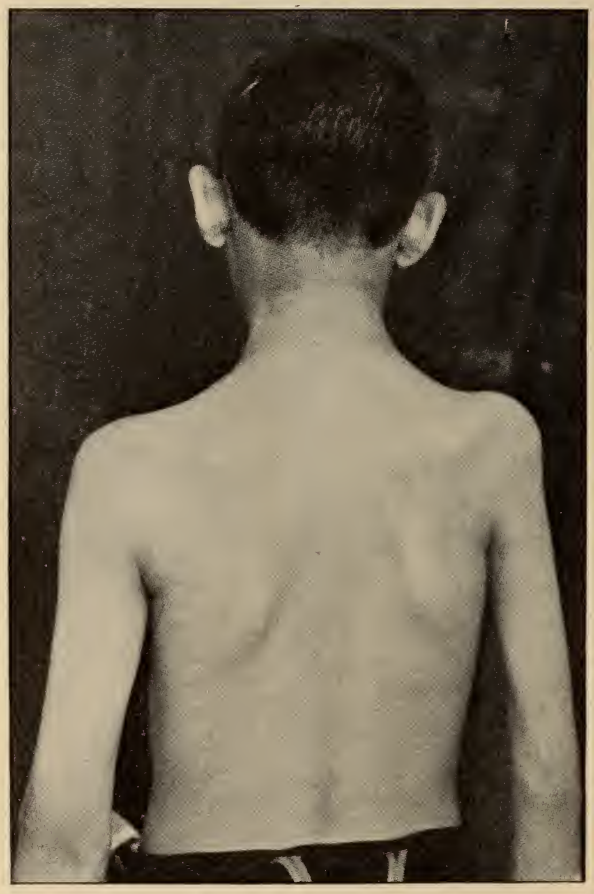
A. F., aged twelve years, native born. Family history good. Three other children. The patient was in good health until the age

FIG. 1.

Marked atrophy of shoulder and upper part of arm.

of eighteen months, when he contracted diphtheria. He was transferred to Randall's Island Hospital, and remained there over two years, on account of a succession of diseases—scarlatina, croup, and cholerine.

FIG. 2.



Atrophy of muscles over scapula and asymmetry about shoulder-joint.

About one year after the patient's removal to Randall's Island the mother, on visiting the hospital, noticed that the child's face had become paralyzed. On her next visit, a week later, she found the right arm swollen and hanging limp at his side. Although the his-

tory in regard to this point is somewhat unsatisfactory, the mother was informed that the child had fallen out of bed and dislocated his shoulder. At this time the fingers could be readily moved.

FIG. 3.

FIG. 4.

FIG. 3.—Subluxation of humerus spontaneously produced.
FIG. 4.—Subluxation spontaneously reduced.

The patient applied for treatment at the Hospital for Ruptured and Crippled about five years ago. Electricity and massage were advised, and both have been faithfully tried, without any beneficial effect.

At the present time there is facial paralysis fairly well marked. The taste is intact, but the hearing in the left ear is diminished. There is atrophic paralysis of the deltoid, teres minor, supraspinatus and infraspinatus muscles (reaction of degeneration in these muscles). There is atrophy from disease of the triceps and flexor muscles of the arm. The faradic excitability is somewhat diminished. There are no sensory disturbances.

The shoulder-joint is quite loose, and the patient is able to produce a forward subluxation of the head of the humerus and then reduce it spontaneously.

The present condition is the result of anterior poliomyelitis.

POINTERS ON THE LEATHER SPLINT.

(Paper Abbreviated.)

By A. J. STEELE, M.D.,
ST. LOUIS.

The making of leather splints or braces consists of three steps: 1st, the mould; 2d, the cast; and 3d, fashioning the leather. The mould is made by wrapping well-wetted plaster-of-Paris bandages, in a number of layers, around the part of the body affected, which having hardened is cut down in the centre, sprung off, and the edges brought together. This mould is filled with creamy plaster, which soon hardens. The mould being now peeled off leaves an exact counterpart of the body, which becomes the cast. This may be modified by cutting away or adding to—*i. e.*, it may be made into an improved shape if desirable. The cast having been thoroughly dried is wrapped about with leather, softened by being well soaked. Half-tanned leather is best, though skirting is generally used. A cotton trout-line is wound with great force about the leather, a pedal-lever being used for the purpose.

If, on account of its thickness, the leather cannot be forced into marked depressions or hollows a slanting cut is made into the leather, the knife being held obliquely; this allows the leather to overlap, and thus, however irregular the cast, it will closely adapt itself to it. The leather-bound cast is now placed in a slow, ventilated oven. After the leather is dried the oven-heat is raised and pushed to almost charring the leather, which thus becomes very hard. After removal from the cast the leather is ventilated by holes made with a modified centre-bit, the overlapped places riveted, trimmed as necessary, eyelet-hooks inserted, and the whole shellacked outside and in.

Very efficient braces are thus made for trunk and limbs. [Specimens of the work were exhibited.]

DISCUSSION.

Dr. McKenzie said that rawhide-jackets could be made quite successfully, that they would wear indefinitely, and are lighter and more elastic. They were made in very much the same way as the leather ones, except that baking would destroy rawhide. Two or three weeks must be allowed for drying them.

Dr. Gillette asked if the leather corsets did not become disagreeable in hot weather from the action of the perspiration.

Dr. Steele replied that by occasionally baking them they could be sterilized, and any unpleasantness from this source avoided.

Dr. Weigel said that he had been told by a leather worker that water which was not too hot to allow the hands to be immersed would not injure leather.

REPORT OF A CASE OF SPASMODIC TORTICOLLIS.

By CHARLES E. THOMPSON, M.D.,
SCRANTON, PA.

W. E. R., aged fifty years, American, carpenter. Has worked at carpenter work for thirty-five years; is temperate; has had gonorrhœa, but denies syphilis; is an inveterate smoker.

Family History: Mother living and well, seventy-two years of age; father died of Bright's disease; two brothers and one sister living and well; has two children, aged ten and fifteen years respectively, living and well. Patient was perfectly well till 1887, when he suffered from a severe attack of typhoid fever, when he was delirious four weeks, and in bed over two months. After this he noticed twitching of the muscles of the neck, suffered from sciatica for two months, and twitching in the neck grew worse.

In September, 1892, he went to the German Hospital, Philadelphia, and was treated by Dr. John B. Deaver, electricity and stretching being used for five weeks. He was not improved by this treatment, and was admitted to the Medico-Chirurgical Hospital, where he was treated medically by Dr. Burr for four weeks. He was seen by Dr. Laplace, who operated on him, dividing the sternocleidomastoid at its sternal attachment by a free incision. Two weeks later he was discharged, and came home feeling better; but in three weeks his twitching reappeared, and one week later he returned and had the operation repeated, but this time the wound discharged for five weeks. After this the patient was improved for a few weeks, but his trouble returned, and in 1894, two years afterward, he went to the Medico-Chirurgical Hospital again, and both sides of the back of his neck were operated upon. Profuse hemorrhage followed, and the symptoms became exaggerated and continued to grow worse until 1896, when he returned to the Medico-Chirurgical Hospital again and

was treated by Dr. Burr, who injected $\frac{1}{200}$ grain of atropine into his neck once daily for a month. This appeared to do him some good for a time.

In May, 1897, he was presented to the Scranton Clinical and Pathological Society. At that time his head was drawn to the right side and the face to the left, the right sternocleidomastoid was apparently shortened, and at very frequent intervals was spasmodically contracted, these contractions extending to the muscles of the mouth, eyes, and forehead. The patient wore a brace attached to his body, with an upright bar extending to the back of his head, and fitted with a head-piece, back into which he would press his head. He claimed he obtained relief from this proceeding.

The contractions continued to grow worse, and he applied to us for treatment, and was admitted to the hospital on March 20, 1899. On the following morning, under chloroform anæsthesia, we cut down in front of the sternocleidomastoid muscle and divided the auricularis magnus, which at that time we supposed to be the muscular branch of the spinal accessory, since on deeper dissection we had failed to find that nerve. We then turned the patient on to his chest, and allowing the head to rest on a support provided for the purpose, at a considerable lower plane than the operating-table, we made an incision three and one-half inches long through the skin and trapezius and between the splenius capitis and complexus muscles, three-quarters of an inch from the median line down to the transverse processes, and resected the posterior division of the second and third cervical nerves. We closed the wound with deep silkworm-gut sutures. The patient seemed to be somewhat relieved by the operation; but the results, on the whole, were disappointing, the sternocleidomastoid contracting as vigorously as ever.

The wounds healed kindly, and two weeks later we made another incision in the line of our anterior one, and this time found and resected the muscular branch of the spinal accessory, but again we were doomed to disappointment in the results, for while the anterior part of the sternocleidomastoid appeared to be paralyzed, its posterior portion and the anterior part of the trapezius continued to contract as with renewed vigor, and the painful looking movements went on.

On May 24th we made another incision, this time along the posterior border of the sternocleidomastoid, and resected a portion of

the superficial branches and also a portion of the deep branches of the external series of the cervical plexus.

This has apparently completely paralyzed the sternocleidomastoid and trapezius. At times the patient remains perfectly quiet, and at all times can voluntarily control the spasms for some time; while, again, the muscles on the opposite side contract, drawing the head backward and to the left with considerable force. Whether he will continue to improve, as in the other case here reported, or whether it will be necessary to do more surgery on him, remains to be demonstrated.

FURTHER OBSERVATIONS ON THE TREATMENT OF CONGENITAL DISLOCATION OF THE HIP.

By ROYAL WHITMAN, M.D.,
NEW YORK.

An advocate of the positive treatment of congenital dislocation of the hip often finds himself placed at a disadvantage because of the misapprehension of its nature and its consequences; for the usual conception of the congenital displacement is that it is a form of loose joint which causes a limp—a deformity rather from the æsthetic than from the practical stand-point. If, then, the atrophied and displaced muscles and the rudimentary articulation do not at once take on normal function—in other words, if the patient does not cease to limp—the treatment is likely to be classed as a failure. It is well, then, to state at the outset of the discussion that a dislocation is always a dislocation, whatever may have been the cause. In the traumatic displacement of childhood there is deformity, fixation, and shortening, and thus great immediate disability, which gradually lessens as the displaced parts accommodate themselves to the new conditions; in the congenital form there is a progressive shortening, and usually deformity and limitation of motion, so that in adult life, but for the history, it would be impossible to distinguish between the two. As the displacement in the traumatic form is immediate and extreme, the time during which replacement is possible is limited to months; in the congenital form the displacement is at first slight, and it progresses slowly, therefore the time-limit may be extended to years.

In the traumatic dislocation the acetabulum is normal and the muscles are competent to resume their functions, thus perfect cure should follow prompt and effective treatment; but if the changes incident to delay make an extensive operation necessary, in order to replace the femur, function is almost inevitably impaired. In the congenital form the acetabulum is undersized or misshaped, and the

muscles have developed under abnormal conditions, so that perfect functional cure is often impossible.

The etiology of the traumatic displacement is evident, but that of congenital dislocation must always remain somewhat conjectural, the most reasonable theory, as applying to the majority of cases, being that of intra-uterine pressure upon the flexed thigh; and if, as Heusner's observations would seem to show, the capsule of the hip-joint is more lax and is weaker in the female than in the male, the disproportion between the sexes would be accounted for. If the displacement is present early in intra-uterine life the parts may be considerably distorted, but it is more probable that it occurs at a later period of development, and that at birth it is practically a subluxation; this becomes a complete displacement under the influence of muscular action, and it is confirmed and increased by functional use.

At birth, then, it may be assumed that in a large proportion of cases the replacement of a practically normal femur into an acetabulum of sufficient capacity to contain it would meet with but little resistance, and that if it could be retained for a time in that position development might proceed in a normal manner. When the child begins to walk, or at the time when diagnosis should be made and when treatment should be begun, the resistance to replacement is not great, provided the inlet through the contracted capsule is practicable; but the disproportion between the capacity of the acetabulum, which has meanwhile been deprived of its normal stimulus, and the head of the bone has increased. With each succeeding year, at this period of rapid growth, the effects of the abnormal use shown by changes characteristic of strain and pressure upon the head and neck of the femur, the non-development of the acetabulum, the elongation and hypertrophy of the capsule, and the accommodative adaptation of the muscles become more marked, and thus the possibilities of successful treatment are progressively lessened.

That congenital dislocation of the hip is a serious and progressive deformity might be predicted simply from the study of the anatomy of the displaced parts; but the fact may be demonstrated by comparing the symptoms and the physical signs presented by children in early and in later childhood, for which the larger clinics offer abun-

dant opportunity. From this point of view unilateral dorsal displacement of the hip may be considered somewhat as follows: as the head of the femur is displaced upward and backward the pelvis is tilted downward and is rotated forward; as a result the lumbar lordosis is exaggerated, and the patient walks, as it were, sideways,

FIG. 1.

FIG. 2.

FIG. 1.—Case III. Showing the inclination of the body toward the shorter leg.
FIG. 2.—Case III. Before operation, showing the abnormal lordosis and rotation of the pelvis.

one anterior superior spine being habitually in advance of the other. (Figs. 1 and 2.) The yielding capsule does not offer a secure resistance to the weight of the body, thus the limp of a short leg is increased by its elasticity and by the insecurity of the muscular support to the peculiar lunge that characterizes the congenital displacement. In early life the articulation is abnormally loose, and motion is

practically unimpaired, but with advancing years the shortening is increased by a gradual ascent of the femur on the pelvis, and motion is restricted in extension and abduction, and, finally, contractions appear corresponding to the habitual attitude. Even in childhood the relation of the pelvis to the femur has been one of flexion because of its abnormal inclination, and in the adolescent it will be found, when the lumbar spine is forced upon the table, that the displaced limb is permanently flexed from twenty to thirty degrees, that the range of abduction is very much restricted, and in many instances that the actual shortening of displacement, averaging at least two inches, is still further increased by the adduction of the limb. (Fig. 3.)

FIG. 3.

Congenital dislocation in an adolescent, illustrating the flexion-contraction in a well-marked case.

The earlier and more direct effects of the congenital displacement are the limp and insecurity of muscular support; thus the child is often easily fatigued, and the fatigue may be increased to discomfort on overexertion. This discomfort is likely to become more noticeable as the weight of the body and the strain of use increase with advancing years. The effect of the strain and friction is very evident in the increased distortion of the displaced parts, as seen at operations on older children, and particularly in the museum specimens from the adult, which, indeed, may be so changed, atrophied, and worn away as to be almost unrecognizable.

In the progress of the deformity there are doubtless periods of intermittence, as suggested by depressions in the pelvis worn out by

the pressure of the head of the femur, and in certain cases in which overuse has been avoided, and especially when palliative treatment by braces has been employed, a rudimentary joint of sufficient resistance to hold the femur permanently, and yet to allow free motion, may be formed; but, as a rule, the stability that ensures comparative comfort is accompanied by limitation of motion and by deformity.

I may anticipate a possible criticism by admitting that patients, in early childhood at least, do not usually complain of discomfort or of weakness. This, taken in connection with the fact that the older patients do not often apply for treatment, might seem to be a very effective argument in favor of non-treatment, were it not that the same assurance of comfort and ability may be obtained from children affected with almost any variety of chronic disability or deformity, even from those who are distorted by tuberculous disease of the hip or spine. Neither do adults of this class consult physicians except for the relief of actual suffering when the hope of cure has been abandoned. In fact, I think it may be stated that, in orthopedic practice at least, the direct testimony of the patient is of comparatively little value as compared with the physical evidence, because of the inability of one affected by chronic disability to appreciate the normal standard. This self-deception and unconscious mental and physical accommodation to disability are palliatives on which we may count when cure is impossible, but which should not be allowed to deceive one or to excuse the neglect of any possible opportunity to straighten or to strengthen the human machine.

I have considered congenital displacement from the physical and anatomical stand-point, and have compared it with the traumatic form, in order to present the subject in a tangible and practical shape, for, as it must be admitted that perfect functional cure is impossible in many instances, it is important that positive treatment should be regarded as a preventive as well as a curative procedure, to be judged, therefore, not by immediate but by the final results.

It may seem, perhaps, that an elaborate argument is unnecessary to prove that a loose, ill controlled joint, causing a lunging limp, friction, progressive shortening, contractions and disability, is an important deformity, and thus worthy of considerable sacrifice of time and labor if it might be ameliorated, even; but the statements in the recent text-books and the discussions of societies that may be

supposed to shape medical opinion show that the gravity of the disability is not appreciated, and that the shortcomings and the dangers of positive treatment are exaggerated. In fact, at the present time it is rather in spite of medical advice than because of it that the opportunity for treatment is afforded when the chances of cure are most favorable.

Taking all considerations into account, success in the treatment of congenital dislocation of the hip depends—

1. Upon the proper performance of the operation of replacement and upon the quality of the after-treatment.

2. Upon the age of the child and the acquired abnormalities of structure and function.

3. Upon congenital malformations that are not amenable to correction.

Practically speaking, there are at present but two accepted methods of treatment of congenital dislocation of the hip:

1. Forcible replacement and immediate use—the functional weighting method of Lorenz.

2. The open operation of Hoffa, as modified by Lorenz.

The functional weighting method was suggested by the operative demonstration that an acetabulum of fair size is usually present in the normal position. If the head of the bone can be passed through the capsular ring and fixed in an attitude of extreme abduction in order to insure stability, then the weight of the body, forcing the femur against the rudimentary depression at every step will gradually enlarge its capacity, and at the same time the displaced muscles will take on a more normal function. If, however, the replacement is not perfect, or if the opposing bones are not properly fixed in direct contact with one another for a sufficient time, cure by this means is impossible. Imperfect reposition is apparently the common cause of failure. All the indications of successful reposition, as enumerated by Lorenz, the shock and audible sound of apparent replacement, the fixation in the attitude of abduction, can be produced in almost any case in which the operation is suitable, yet the supposed reposition may be in reality a transposition of the head to the immediate vicinity of the acetabulum, where it lies, apparently separated from its proper position by a fold of the capsule. Such cases simulate reposition so closely that only functional use or the examination by

the Röntgen ray will demonstrate the failure, and I am sure that many of the successes reported within a short time of the operation were in reality of this nature. In fact, I have come to regard it as a preliminary and tentative procedure, which in a larger proportion of selected cases even must be supplemented by the open operation. In this sense the treatment is most useful, and it has very great advantages over the older method as the primary operation. For example, it is free from danger, and there is no necessity for hospital treatment or even for confinement to bed. Thus the consent of the parents can be readily obtained as soon as the disability is discovered, while, as a rule, there is a long delay before the open operation is permitted. If the operation is successful there need be but little after-treatment, which is an essential part of the open method, because the muscles regain their function, in great part, while the limb is supported by the plaster bandage, and there are no contractions or other deformities to be feared. If the operation is unsuccessful it will have served a useful purpose, because the compensatory deformities will have been lessened by the supporting plaster spica, the contractions will have been overcome, and the secondary operation may be more easily and quickly performed when the head of the bone lies in the anterior position. Even if further treatment is abandoned at this stage marked improvement will have been accomplished, because the support of the body is more nearly in the normal position, because the shortening has been much reduced, and because the resistance of the tissues about the anterior superior spine checks, in great degree, the progress of the deformity.

My own experience in this treatment is as follows: I have operated thirty-two times on 22 cases in 21 patients; in seven instances 2, and in 2 three attempts at reposition having been made on the same patient. The first operation was performed in July, 1896, the last in May, 1899. In 19 instances the displacement was unilateral, in 2 bilateral; in 1 of these cases one, and in the other both hips having been treated. Nineteen of the 20 patients were females.

The patients may be divided into groups according to age.

1. Two years or less, 7 patients, 8 cases.

Two are cured, 4 are under treatment, the present indications being favorable. In 1 case the treatment failed and the open operation was subsequently performed.

2. Between the ages of two and four years, 9.

One of these cannot be traced; in 8 the head of the bone was transposed; in 4 of these cases further treatment has been declined, and in 4 the open operation was subsequently performed.

3. Between four and nine years, 5.

FIG. 4.

FIG. 5.

FIG. 4.—Case I. Two years after operation.
FIG. 5.—Case II. Eighteen months after operation.

One is cured and 1 is under treatment. On 2 the open operation was subsequently performed, and in 1 case treatment was discontinued.

The successful cases may be summarized briefly as follows:

Case I. P., female, aged nineteen months, displacement of the left hip. Operation, April 19, 1897. All dressings removed October 11, 1897. No trace of disability remains. (Fig. 4.)

Case II. S., female, aged eighteen months, displacement of the left hip. Operation, November 15, 1897. Dressings removed August 3, 1898. A complete cure.

Fig. 6.

Fig. 7.

Fig. 6.—Case III. After operation. Compare with Fig. 1.
Fig. 7.—Case III. Two years after operation. Compare with Fig. 2.

Case III. O'H., female, aged five years. Operation, May 20, 1897. A plaster spica bandage was worn until March, 1898, a simple jointed brace with a pelvic girdle until recently. A complete cure. (See Figs. 1, 2, 6, and 7.)

It will be noticed that a large proportion of these cases were, as regards age, of the distinctly favorable type, yet but 20 per cent. were cured by this method. For this reason I am inclined to look upon it as a preliminary or preparatory treatment, in which the prospect of success is dubious except in children at a very early age. I should be tempted to make this statement stronger, but for the fact that the third cure was of a child of five who suffered from a most pronounced and disabling displacement. She had been under observation for three years before the consent of the parents to treatment could be obtained. At that time the leg was one and three-quarters of an inch shorter than its fellow, and the child could hardly walk a block without fatigue and discomfort. She is now as strong as other children, and shows no trace of deformity other than a slight atrophy of the hip muscles and a slight reminiscence of the former spinal deviation.

As far as the details of the operation are concerned the directions of Lorenz have been carefully followed, except that manual traction has been used in the place of instrumental at the time of operation. This is to be preferred, in spite of the labor involved, because the force and pressure can be better regulated. In the treatment of older subjects preliminary traction in bed is preferable to either. When the shortening has been entirely overcome, manually or otherwise, the phenomena of apparent reposition can be produced with ease. In my earlier experience, looking upon these as indicative of actual replacement, I supposed the failures to be caused by redisplacement favored by an anterior deviation of the neck of the femur. On this account the short spica was discarded in favor of a bandage including the foot, in order to rotate the entire leg inward ; but the results were no better than before, and it seems most probable that the cause of non-success is the failure to force the head of the bone fairly through the capsular ring. If, therefore, the operation has been properly performed, and if the limb has been retained in proper position in the after-treatment, there is little hope of success in repeating the procedure.

At the present time I am very careful to force the head of the bone into its proper position midway between the anterior superior spine and the symphysis directly below the inferior spine of the ilium. In this position it is fixed by a short spica in extreme ab-

duction and in as much inversion as the form of bandage will assure. There is, as a rule, but slight discomfort even after prolonged manipulation, and no local signs other than occasional swelling and discoloration about the adductor region and the genitals. The possibility of injury to the epiphysis or fracture of the femur during attempted replacement suggests itself, but of this there appears to be little danger. The cartilage of the head is subjected to some pressure, and in several of the cases in which the attempt at replacement had been repeated subsequent inspection at the open operation showed minute hemorrhage spots beneath the cartilage, and in one case slight irregularity, although the surface was not abraded.

The plaster bandages are renewed at intervals of from six to eight weeks according to their condition. At the first change of dressing it is often impossible to distinguish between a reposition and a transposition, as the measurements of the legs are equal, and as one hesitates to move the limb for fear of displacing it. At the second dressing, however, the head of the transposed bone may be distinguished below the anterior superior spine to the outside of its normal position. Even when reposition is complete, success is assured only after prolonged functional use, not even the evidence of the Röntgen picture being proof that the new joint is stable.

The plaster spica is continued from six to eight months, and is then replaced by a flannel bandage, or by a simple brace as used after the open operation. The functional result in the successful cases is practically perfect. This is explained by the age of the patients on whom the procedure is likely to succeed, because the abnormalities in such cases must be slight, and because there is no traumatism inflicted, as in the open method.

My own experience leads me to consider the functional weighting operation of Lorenz as quite inadequate as a final treatment for congenital dislocation of the hip. The chances of success are excellent in very young subjects, but they diminish rapidly with age, and in older patients it is usually merely a preparation for the open operation.

The Open Operation. As has been stated, the open operation should be supplementary to forcible correction, yet of the nineteen open operations that I have performed but seven were preceded by the simple replacement, for the reason that the patients were hos-

pital cases, and a hospital is manifestly an improper place for a method of treatment that requires many months for its completion.

The manner of operation has been slightly modified from that of Lorenz. The joint is opened by a lateral incision just below and an inch to the outer side of the anterior superior spine. This exposes the fascia, through which the line of junction between the tensor vaginæ femoris and the gluteus medius muscles may be seen; when these are separated from one another the capsule of the joint is at once exposed, often covered in part by the fibres of the ilio-psoas muscle. The capsule is opened by an incision in the line of the neck of the femur, and through this the head of the bone may be exposed after the division of the legumentum teres, if it be present. The finger may then be passed through the opening downward and forward to the acetabulum, and by its side a strong cervix dilator is inserted, with which the capsule is thoroughly stretched, especially the anterior layer which covers the acetabulum. The acetabulum is excavated to the extent that seems desirable by means of a sharp spoon, the bayonet-shaped instrument being the most convenient, after which the head of the bone is replaced; the wound is closed, except for a small gauze drain enclosed in rubber tissue, and a plaster-of-Paris spica bandage, including the foot, is applied, with the leg in an attitude of moderate abduction, complete extension, and slight inward rotation. There is, as a rule, little difficulty in the reposition when the primary operation of forcible correction has been performed, or when the accommodative contractions have been thoroughly overcome by preliminary or immediate traction; but in older patients a more extensive division of the capsule may be required. Ordinarily the operation may be performed in less than half an hour; there is little shock, and the subsequent discomfort is slight. As a rule, the patients remain in bed but a week, and are often about in the chair in a few days. In fact, under proper conditions the operation need occasion no particular anxiety. The dangers and difficulties are caused most often by neglect to overcome completely the contractions before the joint is opened, so that the long-continued and violent manipulation necessary to accomplish replacement exposes the patient to infection. The long plaster spica bandage is exchanged for one reaching to the knee, in about four weeks, and the child is then allowed to walk about. After a month

or two the bandage may be replaced, with advantage, by a light-jointed brace attached to the shoe and to a pelvic band. Such an apparatus serves to steady the weak part, to hold the leg in the proper attitude, and it will allow for pressure over the trochanter if desirable.

In many instances the motion, which when the plaster bandage is removed is free and painless, will rapidly become restricted until the leg may be practically fixed, in part by muscular spasm, in part by voluntary effort, and in part, doubtless, by the changes incident to the repair of the traumatism, since it may be assumed that the head of the bone lies for a time in contact with the granulation tissue that covers the floor of the new acetabulum and with the wounded capsule.

In certain cases, especially in the younger class of patients, the limitation of motion is slight and transitory, but in the older subjects, particularly when the head of the bone has been completely embedded in an excavated acetabulum, it may be obstinate, attended by a marked tendency toward deformity. In such cases, it may be noted, there is, as a rule, no pain or discomfort except on forcible manipulation. In view of the comparative freedom of motion when the first dressing was removed, in several cases I prolonged this preliminary fixation in the plaster bandage without, however, improving the results. It is possible, of course, that if the joint were treated as one would treat disease of the hip-joint, by traction and by removal of weight, this restriction might be lessened; but, on the other hand, it is probable that the pressure and friction of the head of the femur is useful in preserving and perfecting the new acetabulum. I am, therefore, inclined to believe that rest and fixation for a time estimated to be sufficient for the repair of the injured part, combined with early massage, and, if feasible, with the hot-air treatment, would hasten the absorption of the products of repair and lessen the restriction of motion; but, in any event, the tendency toward flexion of the limb must be resisted by frequent manual stretching in the direction of extension, and, if necessary, by traction at night, or even by splinting; for if the complete extension is preserved a sufficient range of flexion for all practical purposes is assured. This careful supervision, more than all else, makes the distinction between a good and a bad result in the difficult cases. In any event, restriction of motion is of small importance compared with the secur-

ity, the improvement in the gait, and the assurance that the progress of the deformity is checked. This theoretical conclusion has been confirmed recently by the testimony of a mother of three children, each having congenital dislocation of the left hip. The eldest, a girl of fourteen years, has nearly three inches of shortening, with its attendant limp. The second child, seven years of age, operated upon last autumn, has at the present time not more than ten degrees of voluntary motion at the hip, but the legs are of equal length, and the limp is so slight that the mother proposes to have the third and youngest child treated as soon as the opportunity offers, because the improvement after the operation has been so great, even at this stage of the treatment.

The statement that limitation of motion is relatively of slight importance does not apply to the bilateral displacement, since even moderate restriction of motion on both sides would interfere very seriously with the ability of the patient, while fixation would be practically disabling. For this reason the problem of treatment is so much more difficult in this class.

In view of the fact that the traumatism of the open operation makes the after-treatment so essential, as compared to that by forcible correction, a modified operation suggests itself. On the supposition that non-success in the Lorenz or non-cutting operation depends upon the failure to force the head of the bone through the contracted opening in the capsule, one may simply cut and dilate the capsule and then replace the bone without excavating the acetabulum. In two cases, finding the acetabulum of fair size, I employed this method; but in one case there was subsequent reluxation, and in the other the head of the bone is not completely contained within the cavity, so that if the method is adopted one should carry out the further steps of the Lorenz treatment by prolonged fixation in the abducted position, in order that the acetabulum may be enlarged by the natural means. This intermediate operation seems worthy of further trial.

In another group of cases the restriction of motion usual after operation is absent. This is explained by the fact that the head of the femur is not completely embedded in the acetabulum, but can be felt somewhat more distinctly than is normal, or there may be even an anterior subluxation. This subluxation is favored by anterior

twist of the neck of the bone, by the absence of the cotyloid ligament, and by an insufficient depth of the acetabulum. The joint appears to be secure, and the shortening of the limb is overcome, but the muscular control of the limb is somewhat imperfect, and the limp is noticeable. The most frequent cause of this subluxation is, as has been stated, the anterior deviation of the neck of the bone, which is especially marked in the primary anterior dislocations. This is shown by the fact that in order to place the head completely within the acetabulum the limb must be rotated inward until the inner border of the foot lies parallel with the table. In two cases in which the subluxation appeared after the healing of the wound I divided the shaft of the femur below the trochanter and rotated the distal fragment outward. This corrected the deformity in part, but it was evident from the difficulty experienced in the attempt to hold the upper fragment backward that osteotomy should either be performed as a preliminary operation, or else the limb should be rotated inward at the time of replacement and retained in that position until the parts were sufficiently contracted to hold it within the acetabulum, after which the secondary osteotomy, that would allow the limb to be replaced in its proper relation, might be more easily performed. At the same time slight abduction of the lower fragment would remedy a depression of the neck of the bone if it were present. It must be borne in mind, however, that an anterior deviation of the neck apparently prevents the adhesions that cause ankylosis; thus the result in this class of cases would be considered much better than when motion is so restricted as to interfere with function.

Of the 19 open operations, which represent my experience in this method of treatment, 15 were performed during the present year, so that the time is too short for a report on final functional results. Fifteen of the patients were females, 1 was a male. Ten were cases of unilateral displacement, 5 were bilateral. Of the 5 bilateral cases, 3 were operated on both sides, 2 on one side, making a total of 19 operations. Four of the patients were between seven and nine years of age, 1 was less than three, and the remainder were from four to six years old. In 12 of the 19 cases the ligamentum teres was present, usually attenuated, never hypertrophied. In the youngest child it was absent, in the oldest it was present on both sides; this, it may be noted, is a very much larger proportion

than is stated by Lorenz. In all the cases an acetabulum could be distinguished. In 17 cases the head of the bone was nearly normal, usually flattened somewhat on its posterior and inferior surfaces; in 2 cases it was markedly deformed, flattened from before backward to an almond-like shape. The direction of the neck is somewhat difficult to determine at the time of operation, but there seems to be often an anterior deviation most marked when the dislocation is primarily anterior. In many instances the neck appears to be shortened, in others it appears to be depressed somewhat (coxa vara); but this, again, is difficult to determine because the part is so small. All of the operations were performed at the Hospital for Ruptured and Crippled. There was no death. There was no operative infection of the wound. In one case, the last in order, suppuration appeared during the course of an acute pneumonia, the bacteriological examination showing that the Fraenkel bacillus was the cause of the infection. This was the only case in which the condition of the patient caused anxiety.

My own impressions of the open operation are that it is not likely to be displaced in the treatment of congenital dislocation. Under proper conditions it is practically free from danger and easy of performance. A certain amount of restriction of motion, even approaching ankylosis, temporary or permanent, may be anticipated when the acetabulum has been excavated and when the head of the bone is contained within it. If motion continues free it will be explained in most instances by a slight anterior subluxation. The points in the treatment that are worthy of further attention are the intermediate operation of replacement without excavation by incising and stretching the capsule; osteotomy, for the purpose of overcoming the deviation of the neck, and a modification of after-treatment, by which the tendency to restriction of motion may be lessened.

The results of the treatment of congenital dislocation of the hip may be summarized as follows: 41 cases have been treated; 22 by the functional method of Lorenz; 19 by the open operation.

On 7 patients both operations were performed. On 7 patients the forcible operation has been performed within so short a time that the results cannot be determined. In five instances further treatment was refused. In all of these a transposition of the head of the femur from the posterior to the anterior position was effected, so that an

improvement may be claimed. Thus there remain 22 cases, or 19 patients on which a report may be made. In 14 the displacement was unilateral, in 5 bilateral. Of the 14 unilateral cases, 9 may be said to have received the treatment of selection—that is, forcible correction was first performed and followed, when unsuccessful, by the open operation.

FIG. 8.

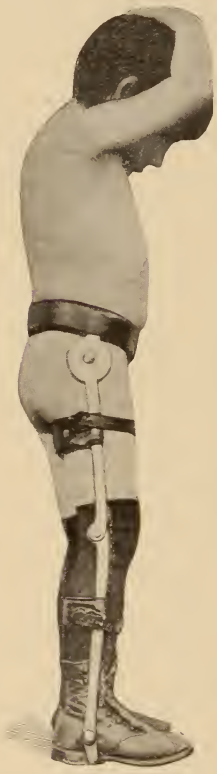


FIG. 9.

FIG. 8.—Case IV. A successful result after the open operation. Shows a useful form of brace to be used in the after-treatment.

FIG. 9.—Case XVI. Open operation. Eight months after operation.

Of this group: In 4 the result is practically perfect cure; 3 by the simple, 1 by the combined treatment—44 per cent. (Fig. 8.)

In 2 cases the result is extremely good, but slight limp remaining —22 per cent. (Fig. 9.)

In 2 the result was good; in 1 of these the dislocation was pri-

marily anterior, and a subsequent osteotomy was required to correct in part the anterior twist of the neck. In this case the joint is firm and motion is free, but a slight anterior subluxation remains. In the other case there is perfect implantation of the head, but marked restriction of motion.

In one case the distortion of the head and neck of the bone was so marked that cure was evidently impossible. The function has been improved, but the articulation is not as yet firm, so that the case is classed simply as improved.

Five patients were operated on directly by the open method. This group was peculiar, in that two of the dislocations were primarily anterior; the treatment was also somewhat experimental, in that in two instances the acetabulum was not excavated.

In 3 cases the joint is stable and motion is practically unrestrained; in one of these the anterior twist of the neck was remedied in part by an osteotomy; in all a moderate limp remains. These are classed as good results.

In one case in which the acetabulum was not excavated there was subsequent reluxation. The patient was readmitted to the hospital, and my successor in the service, Dr. Gibney, replaced the femur by the forcible method, and later performed an osteotomy, for the purpose of overcoming the deformity of the neck. The record states that the legs were of equal length when the patient was discharged.

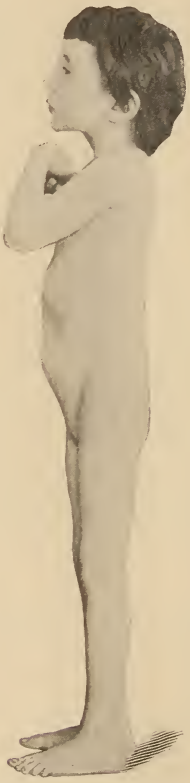
In the case in which secondary suppuration occurred the patient walks with but slight limp, the leg being fixed in an attitude of slight flexion.

The bilateral dislocations have been placed in a group by themselves, because the treatment is more difficult. In the unilateral displacement the patient has a normal leg, to make up for the weakness and insecurity of the other; thus even ankylosis on the operated side would cause comparatively slight disability. But in the bilateral form, at best, the muscles must be inadequate for perfect function for some time after replacement, while even moderate restriction of motion practically disables the patient.

Six patients with bilateral displacement have been treated. One is still in the plaster bandage after the forcible replacement, performed simultaneously on both joints; the others have been treated by the open operation.

In two instances but one hip was treated. In one of these the open operation had already been performed by another surgeon without success. The result in this case is improvement. The articulation is firm and the motion is fair. In the second case, a child eight years of age, the femur is firmly embedded in the acetabulum, but motion is restricted to a range of ten degrees. The other joint is now under treatment by forcible correction, performed by Dr. Gibney.

FIG. 10.



CASE XVIII.—Bilateral dislocation six months after replacement by the open method. Illustrates the change in the contour of the body.

Three patients were operated on both sides. In one case the result is surprisingly good, for although the operation was performed but six months ago, the deformities of the body have disappeared and the function of the joints is good and bids fair to be perfect. (Fig. 10.)

In the second case the operative result is good, but function is imperfect, partly because of the weakness of the muscles and partly because of restriction of motion on the right side.

The third case was in a child eight years of age, and there was an interval of a year between the operations on the two sides. In this case there is but slight motion in either hip, and in addition some flexion deformity on the right side, so that the functional result is bad. It should be stated that none of these patients has received special care or training other than that provided by the hospital or carried out by the parents. Of the entire list of cases, 34 in number, but 2 of the patients are, I think, at the present time the worse for treatment; all the others have been benefited to a greater or less degree, and it may be assumed that the improvement will be increased with the lapse of time.

The object of this paper is to establish the proposition that congenital dislocation of the hip is a serious and progressive deformity, for which positive treatment is indicated at the earliest possible opportunity. This treatment is tedious and difficult and the results must be often imperfect, sometimes because of congenital defects, sometimes because of long delay, and sometimes because of improper surgical methods.

In support of this proposition I have presented only my own experience, because the place of meeting allows me to illustrate it by the patients themselves,[1] and thus to direct the discussion toward the question at issue, which is not of the principles of treatment, but simply of methods and details by which results may be further improved.

[1] Seventeen cases were presented at its meeting, 14 of which illustrated the effect of treatment.

THE SEATING OF SCHOOL CHILDREN.

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As it is often asserted that school chairs furnish one of the influential factors in the development of lateral curvature, a careful study of the proper form of school chair deserves and has received much attention. The results, however, are neither as satisfactory nor conclusive as is desirable, as the seats supplied in our schools are far from satisfactory.

The movement for reform in school furniture may be said to have begun with the publication, in 1841, by Barnard, of Hartford, of his classic work on school architecture. Preceding this publication there had been, however, considerable discussion of the subject. About ten years earlier, in Boston, Dr. John C. Warren and Dr. Alcott, and in New York, Mr. William J. Adams, had begun to advocate the use of sloping desks of proper heights, the separation of the seats from the desks behind, and the use of individual seats with backs.

The use of seat backs began about fifty or sixty years ago. Then followed the introduction of separate seats, and, later, at about 1850, the separate desks and chairs were first used. Attention had also been directed to the horizontal "distance" between the back of the desk and the front of the seat. Although a "minus" distance, in which the desk overhangs the seat, was advocated by some, yet Barnard and Alcott believed in a zero distance, which was, however, a step in advance as compared with the former "plus" distance of several inches.

Barnard was the first to make definite measurements of children of different ages, and to devise from this a scale for the height of the seat and desk. In 1863, Fahrner, of Zurich, published the first European scale. There have since been published in this country the Whitcomb and the Bobrick scales, while in Europe the Frankfort scale, published in 1885, and the scales of the Prague and Vienna Commissions, published in 1892, are the most important. Much attention has been given to the various scales according to which fixed furniture is constructed and by which adjustable furniture is fitted. Being based on different series of measurements of children of different nationalities and classes, there have been considerable differences in the results. Moreover, different standards are taken as the basis from which seat-height and desk-height of adjustable furniture are computed, as, for example, in one scale knee-height and in another total height is taken as a basis.

While the scales have served a very useful purpose in bringing about more accurate fitting, according to averages, they cannot, of course, compare for accuracy in special cases with individual measurements, made, for instance, in the school-measuring chair devised by Dr. Hartwell, in which at one sitting all the required measurements are easily read off. In the use of individual measurements, particularly in weak children and in children above or below the average of those of the same age, and in careful attention to the seating of such individuals, much good may be done, although at present the universal adoption of complete individual measurements can scarcely be expected.

At the same time that so much was being done in the development of various scales, there were introduced many different kinds of adjustable furniture, both desks and chairs.

The problems of desk construction are, according to Cohn (1): to secure such a "difference" in height between the desk surface and seat that the elbow with the arm hanging naturally just reaches the desk, which brings the book at a proper distance from the eye; (2) to secure such a horizontal "distance" between the seat and the desk that the body and head may not be inclined forward too far, in order that the eyes may be near enough to the desk; (3) to have a proper slope to the desk surface. For purposes of reading the ideal slope is 45, because then the eyes can be directed down-

ward without fatigue and without bending the head forward. Such a slope, however, is not practicable for writing, and therefore as a compromise a slope of from one in six to one in ten has usually been adopted.

Modern construction in all adjustable desks meets the requirements of proper height. The problem is simple, because there is no need of automatic change. The need for automatic change by the scholar in the horizontal distance between the desk and seat has been met in two ways: First, by movable desk tops, and, second, by movable seats. Of the movable desk tops there are two types. In one the surface is divided transversely, so that one part may move upon the other, usually the posterior part folding over on top of the anterior, as in the desk devised by Parow, in 1865.

There are also a great variety of mechanisms by which one-half of the desk top slides upon the other. Some are comparatively simple, some are rather complicated, most of them, as of the folding type, are not used because of the break in the writing surface. Some obviate this difficulty by making practically the whole of the desk surface movable, leaving only a small portion at the forward edge fixed, thus approximating the type in which the whole desk top moves. So much weight has been attached to the importance of a movable desk top by Lorenz and Cohn, among others, that much attention has been paid to perfecting the mechanisms by which the desk top as a whole is moved.

Some of the folding and some of the sliding desks meet the third requirements of desk slope by making a change at the same time that they change the distance, so that for reading there is a positive distance with an increased slope, while for writing there is a negative distance and a decreased slope. The Simplex desk of Schenck deserves particular attention. In it the "distance," the "difference," and the slope are altered automatically by a very simple mechanism. By a simple mechanism, also, in the modern Chandler desk the slope and the distance may be changed together or independently, as the scholar wishes. A certain amount of instruction and care is, however, necessary for the intelligent use of a desk of this sort, which is not necessary with those of the simplest construction.

Of course, in the difference in height and the horizontal distance between the seat and the desk the chair must also be considered. Thus many adjustable seats have been made at the same time that the desks were improved. It is now universally recognized, in regard to the chair, that the height of the seat should equal the length of the leg from the sole of the foot to the under surface of the thigh when the feet are placed squarely upon the floor and the knee is bent to a right angle. It is generally agreed that the seat-surface should slope slightly from front to back, so as to counteract the tendency to slide forward, but not slope so much as materially to tilt the pelvis if the child sits sidewise in the seat. The length and breadth of the seat should correspond roughly to the dimensions of the thighs. A seat of insufficient depth can cause no particular harm. A seat of too great breadth allows, while one of too great depth compels, bad postures. The last requirement is, as stated by Hartwell, that "the seat should be provided with a back that shall support the sitter's back whether he be quiescent or actively engaged, as in writing or drawing."

Adjustment for height is a comparatively simple matter. In some cases it is secured by adjustment of the foot-rest, but now all modern seats have simple adjustments in the castings.

In order to obtain an adjustment for distance from the desk several types of seats have been made. As examples, Beyer devised one in which the seat slid on its supports. Wackenroder, one in which the seat slid forward and back together on its supports, and Hippauf one in which the seat, by a parallelogram motion, could be moved forward and back upon its support like an inverted pendulum. In each of these the seat back was attached to the front of the desk just behind, and therefore was available only with a "plus distance." The same was true of the seat of Wandenesch, which secured a plus and minus distance by eccentric rotation on its support.

Various folding seats, such as the "Columbus," of Ramminger, secured the change of distance merely as an aid in getting in and out of the seat. Many modern seats have fixed adjustments for distance, but in most cases where an automatic adjustment is sought for it is obtained through a movable desk top. One seat in particular, devised in Copenhagen, deserves attention, because

the height of the seat, the distance from the desk, the depth of the seat, and the height of the back can all be changed automatically at the same time. The supports at the two sides of this seat are split from above and in front diagonally downward and backward, so that as the seat is raised up by notches it also moves nearer to the desk. The back also is drawn nearer to the desk as the seat is raised. The construction is, however, rather awkward. In some of the Bobrick chairs a similar mechanical principle is applied to the back, although the adjustments are not automatic. There have been a considerable number of seats constructed for home use which are adjustable in all their parts, so that they may be used alike by small and large children, but these are all rather too awkward for school use.

The great problem of chair construction has been the back. Meyer, in 1867, was among the first who carefully studied the question of seating and the mechanisms involved. In the sitting posture the weight is borne principally on the tuberosities of the ischium. When the centre of gravity, which lies in front of the tenth dorsal vertebra, is exactly over a line connecting the tuberosities the body balances without muscular effort. If, however, the body inclines forward the centre of gravity falls in front of the tuberosities, and must be supported by the under surface of the thighs resting upon the front of the seat. If the body inclines backward, there must be some point of support behind the tuberosities, and this is found in the coccyx. If, however, the body leans either forward or backward then the weight must be supported by complicated muscular action unless some additional means of support is furnished. The chair back gives this in the backward position. In the forward position the body drops forward, according to Fahrner, by a series of jerks until the weight is caught by the elbows resting upon the desk. In this position there is a decided tendency to vicious attitudes, the tendency to hang the body from the shoulders rather than let the arms hanging from the shoulders rest easily upon the desk. In the prevention of bad attitudes in the forward position the size of the chair seat, the "difference," the "distance," and the desk slope are of considerable importance as well as the chair back.

In maintaining correct attitudes in the backward position the

chair back is of the utmost importance. As recognized by the Vienna Commission, there are three types of seat backs. The first is the low pelvic support, the second the lumbar, the third the dorsal. These, of course, may be combined.

Meyer favored the pelvic support, because by fixing the base of support for the whole spine it favored an upright position. He considered the last vertebra the most advantageous point of support. Though regarded by him as unnecessary, there may be added a dorsal continuation of his back support— short, and at the same time inclined very sharply backward. Cohn and Hermann agree essentially with Meyer. Meyer objected very strongly to any high straight back, because it forced the child to slide forward on the seat.

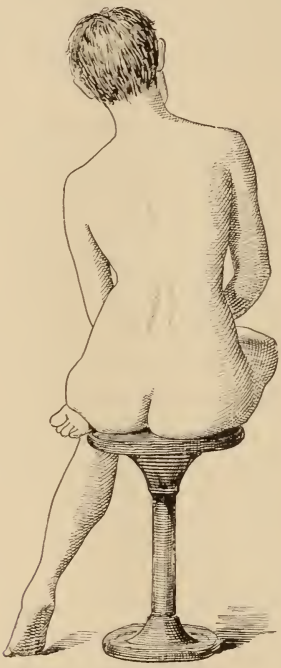
Through the work of Lorenz and Schenck the reclining seat back is now generally used with an inclination averaging about ten degrees. Both of these authors advocate writing in the reclining position, Lorenz at first advocating a desk slope rather more steep than experience has shown to be practicable. Lorenz and Meyer insisted much more strongly than Schenck on the necessity of having a firm lumbar support. Many seats have been constructed with a lumbar support alone, having in view as the main object the maintenance of the normal lumbar curve. One back desiring particular mention is that of Holscher, in which two supporting pads, a transverse lumbar and a perpendicular dorsal, are placed upon an upright rod, the whole inclined backward and adjustable for height.

In spite of all the work which has been done in regard to the chair backs they still remain the weakest point in even the best of the modern school furniture built in this country. It is evident that children with strong backs can get on with no support, especially if the sitting hours are properly regulated; but weak muscles are not uncommon among school children, and the best possible support should be furnished. Such support is given by a chair in which faulty positions are less comfortable than correct ones. Children require a change of position as a relief, and it is desirable that such a change be furnished without tempting the child to attitudes in which the back is less favorably supported.

If children seated, but tired of sitting, are watched, it will be

noticed that they either lean upon the desk or slide down upon the chair, to take as far as possible a reclining position, in order to relieve the downward pressure upon the pelvis and the strain upon the lumbar ligaments and fascia, or by twisting the trunk and sitting to one side or the other, relieve one set of muscles temporarily at the expense of a strain of the others. The photographs taken by Scudder in the public schools show admirably the faulty positions assumed as a result of fatigue and improper seating. Although

FIG. 1.



Faulty attitude in sitting.

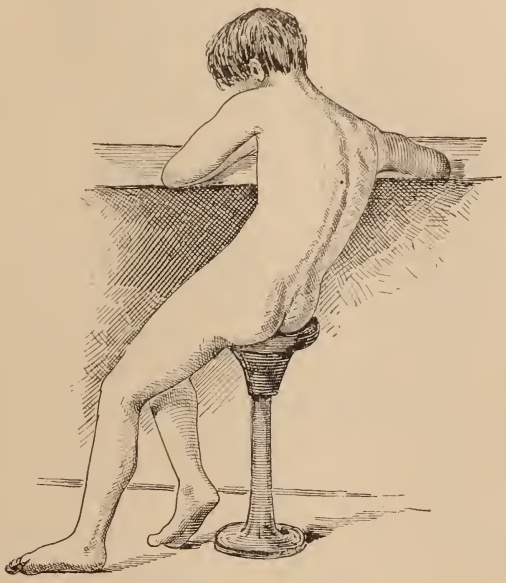
these positions may be assumed without harm for a short time, yet if constantly taken a habit is developed dangerous in growing children.

The danger from leaning upon the desk is minimized by a proper construction, properly adjusted height and slope of desk, which with a sufficiently narrow seat will diminish the tendency to a twisted position of the trunk, particularly if the height of the

seat is properly regulated. Here, also, the general introduction of vertical script has been of marked benefit.

The tendency to slip down in the chair and to assume an inclined position is but imperfectly met by foot-rests and by hollowing the seat so that the buttocks do not readily slip forward. The tired child will instinctively attempt to assume an inclined position as a relief. This should be made possible as far as practicable without depriving the child of the support that is desired in the lumbar region.

FIG. 2.



Faulty attitude in sitting.

A series of back tracings in various sitting positions shows the great change occurring in the lumbar curves and the need of firm lumbar support. Whether the child slides forward on the seat in a reclining position, or leans forward on the desk, or simply doubles up and holds the book in his lap, the normal lumbar concavity is replaced by convexity. When the child slides forward and then leans back the lower lumbar convexity is less marked, because in this position the pelvis becomes fixed when the coccyx touches the seat, but at the same time the head is carried forward by an increased upper dorsal convexity. Leaning forward on the

desk diminishes the normal dorsal convexity, although the lumbar convexity is as marked as in other bad positions. It is essential for a suitable school chair that it should furnish support in the lumbar region, that it should not press the shoulders forward, and that a change from a vertical to an inclined position be possible without a loss of lumbar support.

With a view to allowing a change from an upright to a reclining position, Miller has constructed a chair on entirely new lines. The chair of Hippauf, already mentioned, had the seat attached to

FIG. 3.

Faulty attitude in sitting.

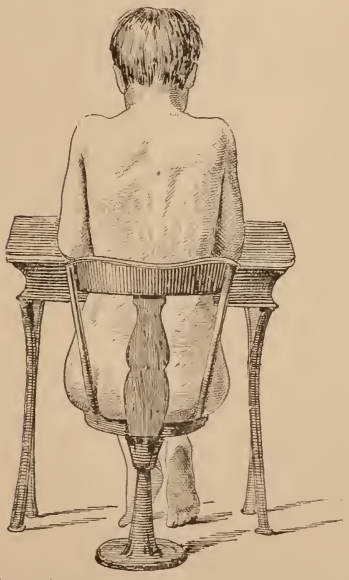
the base by links parallel and of equal length. Miller substituted iron castings for the wooden links, made the front one much longer than the rear one, and placed them at such an angle that they diverge several inches at the top. Thus this chair gives what no other chair has ever given, the ability to move forward into an upright and well-supported position for writing, and the ability to slide away from the desk a few inches into a well supported reclining position for reading.

The back of this chair, which is at slightly more than a right angle with the seat, carries two transverse supports, a lumbar and

FIG. 4.

Faulty attitude from badly fitting chairs and desks.

FIG. 5.



Faulty attitude from badly fitting chairs and desks.

FIG. 6.

Faulty attitude—too small chair and desk.

a dorsal. Each is adjustable for height, the former can be moved forward and back as well.

FIG. 7.

Badly fitting chair and desk.

These adjustments in the back are a great gain over the ordinary chair back. Another marked improvement is seen in the modern spring back typewriter's chair, having a back support adjustable for height, and at an adjustable angle with the seat. The latter mechanism is in some ways more satisfactory than the back of the Miller chair, which, however, has the advantage of a forward and back adjustment of the lumbar support.

FIG. 8.

Twisted attitude.

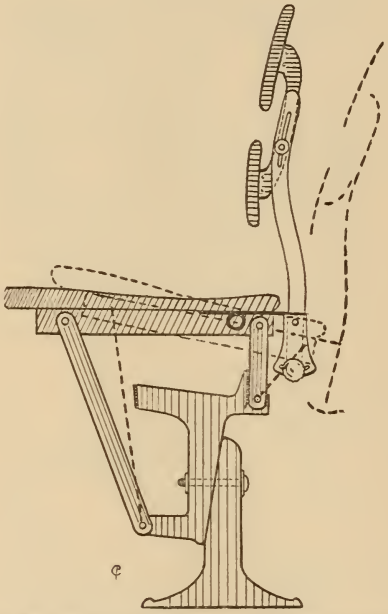
By combining the seat and castings of the Miller chair with the spring back and by replacing the two adjustable pads of the Miller chair and the single pad of the typewriter's chair with a combined dorsal and lumbar pad swinging like a mirror with the long arm uppermost, the advantages of each are secured. In such a combination chair there are secured four automatic changes, by far the most important that from the upright to the reclining position; second, that in the distance from the desk; third, that in the angle between the body and thighs; and, fourth, that in the back supports to conform to changes or individual variations in the curves of the spine.

There are other fixed adjustments, one of importance being that for seat-height and others being for height and angle and strength

of spring of back supports. In ordinary use all of these adjustments might not prove necessary, although those least simple are the ones in actual use in the very popular typewriter's chair.

In the combination proposed there are secured automatic changes in distance from the desk and in the position of the body as a whole. There are also possible automatic changes in the back supports. At the same time the lumbar spine always receives

FIG. 9.



Adjustable chair with swinging back and seat, allowing change of position.

firm, the dorsal spine sufficient support, no matter what the occupation of the scholar. The fact is recognized that improper attitudes result from fatigue, and that fatigue must always follow any attitude, no matter how satisfactory in itself, which is long maintained without change.

It has been regarded as essential that the school chair should in height and depth be adapted to the measurement in length of legs and thighs to the sitter, and that the back should not force the

shoulders forward, promoting a stooping position, nor that the width and shape of the seat or the distance of the chair from the desk favor faulty attitudes. To this can be added that the chair back should give support in the lumbar and lower dorsal region, and that a change of position without loss of support should be furnished for weaker children.

POSITION SYMPTOMS IN JOINT DISEASE.

By HARRY M. SHERMAN, M.D.,
SAN FRANCISCO.

In connection with all tuberculous joint infection—the bones being the sites of the initial joint lesions—there are certain sets of symptoms—viz., the positions which the limbs take, and the changes of those positions, which may be called the "position symptoms" of the joint affection. These symptoms vary with the different joints, but for any one joint are generally fairly constant, both as regards the first position assumed and the subsequent changes of that position, and this constancy is so well recognized that divisions of the general course of the local disease into stages has been based on the sequence of changes.

Attempts to connect the different positions taken by the limbs with definite tissue changes, pathological or reparative in character, which are occurring in the joint, have not been entirely successful, and the general abandonment of the theory advanced by Bonnet, which was at one time generally accepted—that the position of the limb was due to the amount of effusion in the capsule or to the final rupture of the capsule —is an instance of failure of this kind. Barwell says "the cause of this change is quite occult;"[1] but at other times ascribes it to "neuromuscular phenomena"[2]—a term which is too vaguely descriptive to convey any definite idea of what Mr. Barwell meant, and in that respect is occult itself.

Hilton, in *Rest and Pain*, quoted also by Bradford and Lovett, says: "The irritated or inflamed condition of the interior of the joint (say the knee-joint), involving the whole of the articular nerves, excites a corresponding condition of irritation in the same trunks which supply both sets of muscles, extensors and flexors;

[1] International Encyclopædia of Surgery, vol. iv. p. 383, [2] Ibid., p. 382.

but that the flexors, by virtue of their superior strength, compel the limb to obey them, and so force the joint into its flexed condition."

Lücke, according to Bradford and Lovett, agrees that the flexors are the stronger groups, but considers that the patient finds it most comfortable to "hold the limb in a given position," which explains nothing. Lannelongue is quoted as saying the same thing.

Of our own number, Dr. Phelps has offered explanations for the positions and their modifications as seen in disease of the knee and hip. For the initial pathological position at each joint he makes the suggestion that it is a voluntary act on the part of the patient; for the following changes he offers mechanical reasons, claiming that the limb moves toward the stronger group of muscles, and pointing out how, with changes of function of certain groups of muscles, due to changes of position of the limb, there are further definite changes of that position. The first part of Phelps' explanation cannot be accepted. The patient can no more maintain a fixed position by voluntary effort than a sound person can. The voluntary element in the maintenance of the position would utterly exhaust. The patient cannot voluntarily put the limb in the inhibited position, nor can anyone else, except by force against a spontaneous resistance, put it there for him. Furthermore, the position is maintained during sleep, when voluntary action of all kinds is abolished. Certainly, a position from which the patient cannot voluntarily move his limb is not a voluntary position. For the rest, Phelps very rightly does not agree with Hilton and with Barwell that the flexors at the hip and knee are primarily the stronger groups, but he demonstrates such changes in the relative strength of the groups, which come with increase of the initial flexion, as to give the flexors—more particularly the flexors of the knee—a mechanical advantage over the extensors and to make them practically the stronger. With this difference his explanation is identical with that of Hilton, and may be classed with it for the present purposes. Against them both may be urged the objection that they imply—Hilton's words do more than imply—that there is a contest between the various groups of muscles for the control of the limb, that flexors struggle against extensors, abductors against adductors, and so on.

Now, with a normal cerebro-spinal axis a contest of this sort is

something that does not occur; on the contrary, the relaxation of one group, as the extensors, is as definite and as perfectly controlled by the nervous centre as is the contraction of the other group, the flexors, both flexor contraction and extensor relaxation being exactly co-ordinated to the production of the intended movement. Think for an instant of the condition of a man whose muscles, under physiological or pathological stimulus, actually did antagonize each other, really worked against each other for the control of the limb. The only apposite illustration is the victim of strychnine-poisoning, and that picture is graphic enough for all purposes.

A peripheral bone lesion does not alter the physiology of the cerebro-spinal axis, and there is no more reason for believing that the muscles around a tuberculous joint struggle for the mastery than there is for thinking that in our ordinary daily going about our muscles are in combat, and that any one group would oppose and prevent the action of any other group if it could do so. So far, then, as the explanation offered by Hilton and Phelps is based on one group of muscles being, primarily or secondarily, the stronger and dominating the weaker, it must be put aside.

No explanation of those quoted is really satisfactory, for either it does not explain at all or there is defect which negatives the effort and the result. I do not know that I can do any better, but I beg your attention to a simple statement of my conception of the matter.

I shall refer now only to the joints of the lower limbs, though what is said of them is equally applicable to the upper limbs, but with such modifications as are necessary because of the great difference of function, the upper limb being chiefly prehensile in work, while the lower limbs are supportive.

In the three great joints of the lower limbs—the hip, the knee, and the ankle—there are positions of greatest stability in which the joints are most able to bear strain and least likely to be injured in doing it. At both hip and knee this is a position of full extension, for at the hip the femoral head is then most firmly held in the acetabulum, and the heavy, overhanging, upper lip of this socket shows that it is the part best adapted to bear weight, and the knee is obviously most capable of bearing weight when the axes of the thigh and leg are in line. At the ankle the position of greatest

mechanical advantage is that in which the foot is at right angles to the leg, and any departure from this position lessens proportionately this advantage, just as any flexion of the hip or knee lessens the stability of the limb and its ability to bear weight.

It is plain that the amount of the flexion determines, on ordinary mechanical principles, the amount of the loss of functional efficiency for weight bearing, and all positions short of full extension for the hip and knee are positions of comparative efficiency only, and this is true of the ankle as it moves in either direction from a position at right angles to the leg.

By just as much as a joint recedes from a position of mechanical efficiency it approaches one of mechanical inefficiency, and the inefficiency is obviously inversely proportional to the efficiency, for in the hip and knee no supportive force can be exercised when full flexion is attained, and at the ankle the joint is most liable to overstrain and to injury in positions of full flexion or extension.

When a joint is in a position of mechanical inefficiency it is in a position adapted to rest from mechanical work, and the amount of that adaptation seems to be measured, up to a certain point, by the amount by which the joint has been withdrawn from the direct line of force; beyond that point the adaptation for rest lessens and some work begins again. This is evident if we watch the changing conditions at the knee as it passes from full extension to full flexion. To simplify the proposition the muscles may, for the moment, be considered to be entirely relaxed, and then, with full extension at the knee, the posterior and crucial ligaments must be to some degree tense, and this puts some pressure on the bone; this position, consequently, means work for the tense ligaments and for the bones resisting the pressure, even with muscular relaxation. Recoil from the position of full extension relaxes these ligaments, and the pressure of the bone is lessened proportionately with the amount of that relaxation, and lessens directly with increase of the angle of flexion to a minimal amount. When, however, the amount of flexion is such that the ligaments and other tissues on the extensor side of the joint begin to become tense, limiting the flexion, the pressure on the bones begins again, and it now increases with the angle of flexion, until full flexion and the maximal tension and pressure are reached.

The joint has passed from a position where the posterior ligaments were tense and caused pressure on the bones to one where no ligaments were tense and there was no pressure on the bones, and then to one where the anterior ligaments are tense and cause pressure on the bones.

As a tense ligament is a working ligament, resisting tensile force, and as a bone resisting pressure is a working bone, the joint has passed from one condition of bone and ligament work, through a condition of bone and ligament rest, to another condition of bone and ligament work; and it has at the same time passed from a position of mechanical efficiency and ability to transmit weight from one bone to the other to a position in which, the two segments of the limb being folded on each other, the mechanical inefficiency is obvious.

The simple mechanical conditions which have here been detailed are somewhat complicated when the muscles are in the normal state of activity; but in this relation their function may be divided into two parts. In one part they act as accessory ligaments by helping to bind the bones together and by passively limiting motion when their maximal length by relaxation has been reached. In this part of their function they do not complicate the question at all. In the other part of their function they are active and not passive agents, and they hold the limb in definite positions or move it from one position to another. As the bones on which they act are levers, and as the joints are the fulcrums of these levers, their action necessarily entails pressure on the bone—"interosseous pressure"—and the resistance to this pressure is bone work. But the muscles have no independent action; their contraction and their relaxation is controlled by the spinal cord, whence come impulses which are volitional or reflex in character. The pressure the muscles cause on the bones is, therefore, only that amount which is necessary for the work required of them, and it is no more, and it is to this extent that they complicate the question of bone rest and no further. Never do they complicate it by a contraction due to hostile antagonism between groups.

What is said of the conditions in the act of passing from extension to flexion at the knee is applicable to the reverse act at the knee, or to similar acts at the hip in antero-posterior, transverse,

or rotation motions, or to any bone moving between antagonizing groups of muscles.

At the limit of motion in any direction the ligaments restraining that motion are tense, and if the motion is an active and not a passive one, the muscles causing it are contracted. This imposes work on all parts of the mechanism of the joint-muscles, ligaments, and bones. Between this point and the limit of motion in the opposite direction are points which are means between extremes, where the work and strain on all the tissues are relatively less, and these are points of comparative rest for all tissues. They are, too, points of comparative mechanical inefficiency.

To make applications, we see that when a man stands on one leg the other, resting, is flexed a little, rotated out a little and abducted a little at the hip, all these being a recoil from the position of greatest weight-bearing efficiency, and permitting relaxation of flexors and extensors, of abductors and adductors, and the rotators in and out; so far as the capsule is concerned, these same motions together, each taking place to a minor amount, relax the capsule more efficiently than any one or two together could with the same amount of motion. In lying supine there is some recoil from full extension at the hip, and there is a tendency of the limb to roll outward; this latter motion is espeially noticeable in cases of fracture of the femoral neck, and shows that normally muscular control is needed to keep the leg with the toes pointed forward, and that when the inward rotators relax the limb is permitted to roll outward from its position of greatest efficiency.

At the knee the recoil from full extension permits relaxation of the hamstring muscles and the posterior and crucial ligaments, and after a certain amount of flexion has taken place a rotation of the leg outward on its own axis relaxes both crucial ligaments still more, and these positions of hip and knee are those commonly assumed by one who wishes to rest from ordinary fatigue.

At the ankle the natural position of rest is one of slight plantar flexion; this is the real flexion motion for that joint, and the position of rest is, therefore, a slight recoil from a position of efficient extension, this last being a position that cannot be maintained without muscular effort.

Now, when there is a tuberculosis of either or any of the bones

entering into the make-up of a joint, whether the tuberculosis be a single focus, or multiple foci, or an infarct, or a tuberculous sequestrum, the proximate effect is to destroy some of the osseous trabeculæ, and so to lessen the functionating bone tissue—to produce a place of structural weakness. There is no implication, at this time, of ligaments or other joint structures; but there is, I think, an unconscious appreciation of the existence of this weak place in the skeleton, and an involuntary, but none the less definite, shrinking on the part of the patient from putting work on it, even though there is no local pain.

The next step to involuntarily avoiding putting work on such a place would be the selection of a position in which the normal strain incidental to its location in the skeleton would be lessened; at first a little lessened, and then lessened to a greater amount as the lesion increased and the structural weakness with it. As the first step in this the position of maximal mechanical efficiency would be avoided, and at the same time, or very soon after, positions at the limits of motion in other possible directions would be prohibited; later yet, as the lesion extended in size or developed pathologically, the amounts of prohibited motion in the various directions would increase, until the arc of the prohibition of flexion would meet the arc of the prohibition of extension and immobility in these two directions would ensue; prohibited abduction would meet prohibited adduction, and the same would happen to rotation in and rotation out; and as a result of all these we would have joint immobility, the object being to avoid arcs of motion in which bone work was greater and to seek rest in that position in which the strain on the affected bone was the least.

So long as the pathological process was limited to the bone and had not changed its shape the mechanics of the joint would be unchanged; but as soon as the pathological process had affected tissues other than the bones their demands for their rest would be added to that of the bone, and the position assumed would be the resultant of these demands.

Again, if the pathological process had advanced to the point of destroying bone enough to alter the mechanical relation of the parts of the joint, the positions assumed would be just that much

affected, but underlying them would still be the original motive, the selection of the position of least work, of the greatest rest, by the avoidance of positions of potential or actual greater work.

The first abnormality of motion which is usually noticed in the case of hip-joint tuberculosis is prohibition of full extension; at the same time, or very soon after, limitations of motion in other directions, but most markedly inward rotation and adduction. A little later there is definite abduction and rotation outward associated with the flexion. This first assumed position is identical with that assumed by the normal limb at rest.

The common progress of the pathological process and the increase of structural weakness in the bone results in the limb being still further flexed, abducted, and rotated out—that is, more and more debarred from assuming a position of comparative mechanical efficiency. As flexion increases there is, as has been emphasized by Phelps, a change in the actions of the muscles, abductors becoming inward rotators and outward rotators becoming abductors; but this change cuts no particular figure in regard to the pathological position of the limb. It is a statement which is true of every normal joint. But the change from abduction to adduction does still further withdraw the limb from a more to a less efficient position for work, or to a position of greater possible rest, until the final position, of great flexion, adduction, and rotation in, and puts it into a position of practically complete uselessness, where rest is inevitable.

At the knee the conditions are less complex. The initial flexion is easily understood, it being a recoil from complete extension and a position of working efficiency. The increase in flexion, or the increase of the arc of prohibited extension, goes on *pari passu* with the pathological process, the extensors relaxing as the flexors contract. At the same time there is an arc of prohibited flexion, and this, too, increases until the two arcs meet and immobility results in a position in which it is impossible for efficient work to be done, and consequently in a position of comparatively enforced rest. Later, with extension of the process, there is relaxation of the ligaments and a subluxation of the tibia takes place in the same direction as the initial movement, and the possibility of function is further less-

ened, the enforced rest made more absolute. With this movement is a rotation of the leg outward, and this is in a direction to relax the chief ligaments which limit normal extension—namely, the crucial ligaments. The final position is one of marked flexion, rotation outward, and subluxation of the tibia backward—a position of obviously complete mechanical inefficiency, of enforced complete rest.

With tuberculosis at the ankle or in the tarsus there is first a limitation of real extension (dorsal flexion), so that the foot is prohibited from assuming the position of efficient extension; later, flexion at the ankle is limited (plantar flexion), and with the progress of the disease, or its extension, both these arcs of prohibited motion increase until they meet, and immobility results, and the foot is always then in the normal position of rest, and from it it does not move.

Now, if the position ordinarily first selected for rest of the hip-joint is identical with the earliest definitely assumed position in the hip-joint tuberculosis, it is reasonable to argue that the selection in the latter instance is made for the sake of securing rest for the affected tissues. Again, if the earlier, smaller arcs of inhibited motion would lessen bone work, the later, larger arcs are for the same purpose, and finally the limb is held in the position of least bone work, whatever that position may be. At this point we touch the generally accepted idea that the complete immobility of the later stages of joint tuberculosis is for a conservative purpose.

Reasoning backward from this point, if the complete immobility of the later stage is for a conservative purpose, the minor prohibitions of motion in certain arcs in the earlier stages is for the same purpose. In the earlier stages the lesion is a focal tuberculosis in one of the bones; its effect is to produce a point of structural weakness. It is to protect this point from undue pressure that the motion in these arcs is prohibited, for in these arcs there is greater strain on the components of the joint, even in a healthy state.

The mechanical conditions being originally the same in all cases of a given joint, the method of the inhibiting bone work would be by a uniform plan for all ordinary cases; but unusual locations of the lesion, and consequently uncommon changes of the final shapes

of the bone, might result in "erratic" or atypical positions; but still there would be, for those cases, positions of least bone and joint work.

In all stages of the lesion, up to the point of definite ankylosis, it has been the custom for a long time to speak of muscular "spasm" limiting joint motion and finally immobilizing the joint; but the term is inaccurate. I do not believe a muscular spasm occurs at all in the ordinary meaning of the word spasm, which is a convulsive contraction. It is perfectly true that often violent muscular action takes place, but it only does so when, the muscle being fatigued, its tonic contraction, which had been preventing the limb from entering an arc of inhibited motion, relaxes, the prohibited motion takes place and the limb, by reflex stimulus of the muscle, is forcibly withdrawn—so forcibly that it may pass its original position into another arc of inhibited motion, when the other group of muscles would wake to their duty. We see this action in the ordinary "night startings" or "night cries," and similar results in some cases during waking hours; but it is not an uncontrolled muscular spasm; it is an action with a purpose, the removal of a limb from prohibited positions or the prevention of its assuming them, and its violence is measured by intensity of the stimulus, and that is in response to the need of the joint, and the whole series of acts has a definite and finally a useful end.

Coming back to the earlier stages again, we should not say of them that motion is limited to such and such an arc, but rather that motion in such and such arcs is prohibited; for this is the symptom, and the permission of motion in the intervening arc is simply the persistence of the normal condition; and later we should think, to think logically, not that the joint was immobile, but that no motion was permitted, for in both these cases, except where reparative action has made a partial ankylosis, anæsthesia will remove this inhibition by paralyzing the appreciation of the local weakness, the reflex activity of the spinal cord, and the tonic contraction of the muscles, and motion will be possible.

In brief, the symptom is not that motion has a limited range in one part of its arc, but it is that there is no motion permitted in other parts of its arc; and, similarly, Lücke and Lannelongue, who say that the given position was assumed because it was most

comfortable, had better have said it was assumed because it was the least uncomfortable; for pathology implies discomfort, at any rate, and a limb in search of rest because of a pathological condition would progressively exclude positions of their greater discomfort, and so finally arrive at the position of least discomfort—the position of least work.

SOME SALIENT POINTS IN THE TREATMENT OF HIP DISEASE.

By B. E. McKENZIE, M.D.,
TORONTO.

Not only to the orthopedic surgeon, but to the general practitioner and the laity is hip disease a subject of perennial interest. Though this affection has been presented again and again in all its aspects, yet there may be some advantage in setting forth the results of individual study. In doing so, the indulgence of the Association is craved if the writer should seem somewhat dogmatic in the assertion of his own opinions. Through a clear-cut statement of his own views his paper will the better elicit the valuable results of the large experience of the members of this Association.

The question may be regarded as settled, that when an early diagnosis is made, effective mechanical and constitutional treatment is always to be preferred to operative measures. There are few who to-day would adhere to the opinions advocated by Barker in the Hunterian Lectures of 1887. One is scarcely surprised that, stimulated by some important advances of nearly twenty years ago, surgeons went to extremes in operative work. The most important of these advances was the practice of asepticism and the discovery of the bacillus tuberculosis. Strong claims were made in favor of early operation resulting in speedy cure. Everywhere we find surgeons who believed and who acted on the belief that as soon as a diagnosis was made excision of the joint should be performed, thereby removing the femoral head and all infected tissue, cutting short the course of the disease, forgetting for the moment that they were rarely able to eradicate all the infected tissues. It may candidly be said that not all these fair promises held out by distinctively operative treatment were realized.

Although these cases were sometimes sent home in a month or less after the operation, having the wound healed, this seeming to be a most satisfactory and gratifying result, calculated to beget a hope that by operative measures alone these cases can be cured in a short time, yet further observation often showed a recurrence of the disease. Though the greatest precautions were taken, yet untoward results—even death—sometimes followed as the direct consequence of the operation. Even in the cases which took the most favorable course possible, it was found that excision of the femoral head, in itself, is the cause of no slight disability, and in a considerable portion of the cases the focus of disease at the head was not the only one, and subsequently tuberculosis manifested itself elsewhere. There are serious hinderances to the successful accomplishment of the complete eradication of the disease. One of the epiphyses, the one most frequently invaded primarily, is so situated as to be entirely within the capsule. Its removal calls for an excision, which in all cases greatly invalidates the joint function, permitting the limb to slide upward in its relation to the pelvis, thus becoming insecure for the purpose of weight bearing. If the primary focus be in the floor of the acetabulum, as it is in a considerable proportion of cases, it cannot be reached without complete excision.

On the other hand, if the primary focus be found at an early date at either of the trochanters or in the synovial membrane, there is a better prospect of its removal without serious interference with the integrity of the joint. Such definiteness of diagnosis is seldom possible. An early diagnosis of the presence of disease can be made; but to determine the exact location of the primary focus is not possible.

Even operators of the most extensive experience, such as Volkmann and Dr. George A. Wright, have said "that if the case be taken in time the best results are obtained by rest." Mikulicz regularly treats his cases of joint tuberculosis by iodoform injection without incision.

Considering all the evidence and giving due weight to the facts of experience, the writer is of the opinion that operative interference is seldom justifiable before the breaking down of tissue may be diagnosed.

The loss of the femoral head, whether through operation or the destructive process of disease, must be regarded as one of the most

undesirable results. The shaft of the femur slides upward and marked shortening occurs; but what is more serious, the end of the femur does not always secure firm anchorage, and when the weight of the body comes upon the limb the adjustment between the femur and the pelvis is found ill-suited to weight bearing, so that the lack of fixation causes a very marked limp, the patient soon growing weary, the pressure of the femur upward into the tissues not designed to resist such intrusion causing pain. Sometimes the upper end of the femur finds anchorage, and much of the disability is thereby overcome. Shortening of the limb, if it be less than two inches, need not, in itself, be considered a serious matter.

If the position here taken be admitted, that early operative intervention is not to be commended, then it is a most important question to determine what constitutes efficient mechanical treatment.

Before attempting to answer this question it will be well to consider what are the elements which mark the successful result, and what are the final conditions that constitute disability.

1. The most important is the subsidence of the disease, either through the efforts of nature aided by art to completely eradicate it or at least to encapsule the virus and imprison it so successfully as to prevent the manifestation of symptoms of its presence.

2. Motion is desirable if the head of the femur can be preserved and kept in the acetabulum; motion, however, is not the most desirable element in securing a successful result. Firm ankylosis, with the limb slightly abducted and flexed, is not a serious hinderance to the extensive use of the limb.

3. As some shortening is likely to result a slight amount of abduction is desirable, as the apparent shortening is thereby made less. Shortening less than two inches does not in itself constitute serious disability, as it is easily made up by a cork-soled boot.

4. If either disease or operative interference have destroyed the integrity of the joint a movable connection between the femur and the pelvis is a source of weakness and pain.

5. Adduction in any amount is always undesirable. Abduction to a greater amount than a few degrees is a cause of needless deformity. Flexion of more than fifteen or twenty degrees produces deformity and interferes with walking.

6. Atrophy of the limb is likely to cause life-long disability.

The mechanical treatment which implies that a patient shall be confined to bed cannot be considered an ideal treatment, as modern advances have conclusively shown that one of the most important considerations in all forms of tuberculosis is found in free exposure to fresh air and direct sunshine.

The apparatus which shall be ideal must be a portable one, to which the patient is definitely fixed. In the opinion of the writer no apparatus hitherto described has been so successful and so completely meets the indications as the well-known "Thomas hip-splint" and its modifications. The posterior bar should be accurately adjusted. An ill-fitting splint is not only uncomfortable but fails to act efficiently as a mechanical appliance. Before the thoracic and pelvic bands and other parts are definitely attached, it should be accurately moulded, to fit snugly to the body and limb of the patient. Care should be taken that sufficient bend is made at the knee to permit of slight flexion. Following years of hip treatment by mechanical appliances, it is not uncommon to find hyperextension of the knee and relaxation of its ligaments, which cause considerable disability. This unfortunate result is as unnecessary as it is undesirable. In securing fixation of the limb to the splint it is not necessary to bandage the whole limb. Bandaging which confines the entire limb exsanguinates unduly, and when long continued produces atrophy, which is very detrimental to future efficiency. Similarly the use of the ordinary adhesive plaster and its accompanying bandage is not to be commended. Extension by means of buckles sewed on the side of the boot or a well-fitting gaiter is better.

When the splint is employed simply to secure fixation alone it does not accomplish its best results. Traction is just as important as fixation.

The constant tendency in the later stages is toward adduction of the limb and tilting of the pelvis upward on the affected side. If the splint be so constructed that traction can be conveniently made, drawing the limb downward, while the pelvis is secured by straps producing counter-extension, not only is spasm of the muscles overcome, but the adduction, which proves so pernicious, may be prevented. In order to accomplish this latter purpose successfully, provision should be made for making the chief counter-extension on the sound side. A splint which produces counter-extension only on

the side of the affected limb acts at a mechanical disadvantage, and, in spite of traction and fixation, needless and injurious deformity is likely to result.

If, however, through inattention to this matter there is considerable adduction, it may be better to place the patient in bed for a few weeks, so as to overcome the deformity by traction produced by the aid of the weight and pulley. Afterward, however, this position can be maintained by the modified Thomas splint.

Traction which is made in the manner just described is effectual not only in preventing adduction and in overcoming muscular spasm, but it prevents needless attrition of the head of the femur against the acetabulum, and becomes a successful means of preventing actual and needless shortening.

A successful splint should thus enable us (1) to secure fixation for the joint, (2) traction and abduction of the limb. In my earlier years I thought that a third purpose should be served—that a splint should be a crutch. Further observation has covinced me that the encouragement of this idea is likely to be detrimental. The effort to use the splint as a crutch interferes with that completeness of rest from function of the diseased part which it is desirable to have in order to secure the best results.

A valuable and carefully prepared scientific paper was presented to this Association a few years ago by one of its members and a conclusion reached, adverse to the use of iodoform injections, in the treatment of tubercular joint affections. It was a paper so carefully prepared, so full in detail, and so accurate in conclusion that I acknowledge myself greatly influenced by it. Notwithstanding that fact, I am unable to withstand the weight of evidence that years of experience and observation have served to accumulate, that iodoform however employed, when brought into contact with tubercular tissue, is a most valuable adjunct to our means of treatment.

The results of my own experience in the use of this drug coincide very closely with those set forth by Dr. Henle, of Breslau, as the result of the work done in the Breslau clinic in the service of Dr. Mikulicz. Whether injected into the neighborhood of tuberculous joints or into the joint cavity, or whether brought into contact with the tissue after incision made for the purpose of removing broken-down tissue, the writer has observed only the most favorable results,

and has reached the conclusion that it is one of the most valuable aids in treating tubercular joint disease.

The teaching of the last few years should not be forgotten or lightly passed over by the surgeon who is called upon to treat tubercular joints. Pulmonary tuberculosis is to-day considered amenable to treatment in a large percentage of cases. The most important points is securing efficient treatment in this domain are: (1) Early diagnosis; (2) free and constant exposure to pure air; (3) as much direct sunshine as it is possible to obtain; (4) high altitudes and dry air; (5) good nutrition; (6) rest for the affected parts; (7) measures of prophylaxis.

Not only in the sphere of medicine, but in that of surgery, evidence is accumulating to show more and more clearly that it is by attention to the general disease which is present that we must look for the best results.

If the amount of inflammatory product be more than nature can successfully dispose of by absorption, and if the healthy tissue does not become successfully walled off from the diseased structures and the virus continue to extend the area of its noxious influence, so that breaking down occurs, then the débris should be removed by operation, the surrounding tissue being wounded as little as possible, trusting largely to natural processes, aided by drainage, cleanliness in nursing, good diet, abundant fresh air, plentiful exposure to direct sunlight, and rest for the part, to put a stop to the further ravages of the disease and to secure cicatrization.

Of the cases of hip disease that have come directly under my care during ten years, and which have been in the main treated in accordance with the teaching of this paper, I have been able to trace and obtain fairly reliable records in seventy cases. Of this number nine are dead; one, a boy of sixteen years, had Pott's disease and hip disease, and died of general tuberculosis; one, a girl of fourteen years, had Pott's disease and hip disease, and died of general tuberculosis; one, a girl of fifteen years, had discharging sinuses for a long time, and died of amyloid disease; one, a girl of fourteen years, had pulmonary tuberculosis, with cavities when first seen; one, a man of thirty-four years, died two years after recovery. I have not been able to obtain a reliable account of his last illness, but believe it to have been tubercular meningitis. One, a boy of fifteen years, died of

typhoid fever two years after recovery from hip disease; one, a boy of eight years, died of tubercular meningitis, though for several months previously he seemed to be convalescing satisfactorily; one, a girl of sixteen years, had general tuberculosis, with dropsy; one, a girl of fourteen years, died a few days ago of tubercular meningitis. This patient had come under my care early in the course of the disease, and had seemed to make most gratifying progress toward recovery until about two weeks ago, when her fatal illness appeared. With the exception of the last case all had suppurated abundantly, and six of the number had manifested signs of the disease for a long time without having any efficient treatment.

Thirty-six of the seventy cases suppurated; of these, twenty-one made a good recovery, according to the standard of a good recovery set up in this paper. Of these, three have recovered without a limp in walking, although suppuration occurred.

Of the whole number of the cases five have recovered without limp, and five others have but a slight limp.

The oldest patient was fifty-eight years of age, seven were over twenty years of age, two of the number being about forty, and two over fifty.

Permit me briefly to summarize:

1. Hip disease is a local manifestation of a constitutional disease.
2. Early operative treatment is seldom justifiable.
3. When softening can be determined the surgeon should operate and obey indications, observing all care not to injure needlessly the mechanical integrity of the joint.
4. In the future management of the wound asepticism and anti-asepticism must be carefully observed.
5. From the earliest moment efficient protection for the joint should be secured and constantly maintained by a well-fitting mechanical appliance.
6. A proper splint should fulfil two indications—*i. e.*, secure rest for the affected joint and prevent deformity. No effort should be made to employ the splint as a crutch; ordinary crutches should be used. In the adjustment of the splint the knee should be slightly flexed.
7. Constitutional treatment is indicated as in other tubercular affections. Great emphasis should be laid on obtaining the freest

exposure to direct sunshine and fresh air. Free use of iodoform is a valuable adjunct.

8. After excision a perfect recovery never follows, because the mechanical integrity of the joint is not preserved.

9. Following mechanical and constitutional treatment complete restoration of function is sometimes obtained.

10. Even when breaking down of tissue occurs and necessitates incision there is sometimes a perfect restoration, and frequently a highly useful return of the joint function.

A FURTHER VIEW OF THE MANAGEMENT OF THE DEFORMITY OF HIP DISEASE.

By A. B. JUDSON, M.D.,
NEW YORK.

Having tested by further experience the value of a promising method of preventing and correcting the deformity of hip disease, I desire to call attention to the subject again. In a paper read before the Association in 1889 a number of clinical facts were set in order, and from them deductions were made in favor of this method, which, omitting preliminary and argumentative matter, may be said to consist in the education of the patient, wearing the hip splint, to the habitual observance of the normal rhythm of human locomotion. At the risk of repetition, I will recall a few points.

The deformity and factitious shortening are caused by the patient's instinctive and habitual effort to keep the affected limb clear of the ground by elevating the pelvis on that side, with adduction as a necessary accompaniment (flexion and adduction are here considered in the same category). The patient does this to escape the pain which might come from a sudden and unexpected contact of the foot with the ground, and also to withhold the bad foot from the ground in favor of the well one, which hastens forward to do the work. The result is that the affected foot visits the ground for a moment only while the well one lingers on the ground, and the natural rhythm, or time, is destroyed. True time may be expressed as follows:

One—two—one—two—one—two—one—two,

and false time thus:

One—two——one—two——one—two——one—two——one—two.

It is found that if the patient gives up false and resumes true time, which can be done by an effort of the will or as the result of drill, the affected limb gives up some of its adduction and flexion, in order to reach the ground more conveniently to do its share of the work;

with this come also horizontal adjustment of the pelvis and a decrease of shortening.

Violation of rhythm and the deformity appear to be incidents of nature's method of protecting the diseased joint from pressure and concussion by transferring a large part of the work of locomotion from the affected to the sound limb. One of the advantages of treatment by the ischiatic crutch is that it furnishes complete protection with a return to natural rhythm and release from adduction, apparent shortening and tilting of the pelvis. This will demand an apparatus strong enough to give to the body the support which it is accustomed to receive from a well limb.

Patients who have recovered with serious lameness, when instructed in this simple mystery, have overcome a large part of their lameness and deformity by learning to observe natural time in walking—an improvement which could not be expected, of course, if bony ankylosis were the result of hip disease. It is an interesting fact that throughout the early and active stages of the disease the position of the limb readily yields without pain to a slight amount of continuous force. Even after recovery the condition is far from immobilization or intractable fixation.

It may be said, by the way, that the rhythm of human locomotion is a subject which has probably not received the attention to which it is entitled. The very simplicity of the normal rhythm makes a slight deviation from it very noticeable, as in the incipient lameness of a child who simply accentuates the blow given to the ground by the well foot. Violation of rhythm is one of the constituents of lameness. Lameness is asymmetrical walking, symmetry of gait requiring similarity of the two limbs not only in their length and relation to the rest of the body, but also in their movement. It is a point of practical importance that the lame needlessly add to their lameness by neglecting to keep correct time with their feet. A well person can pass for lame by the simple device of giving more time to one foot than to the other, a matter capable of instant demonstration, and one who is lame can lessen the appearance of being so by observing the natural rhythm of locomotion. If the trouble is the result of hip disease, not only is the appearance improved, but the cause of the lameness is by this method lessened with the removal of adduction and undue flexion.

This method is naturally placed in comparison with operative correction. Warm personal regard for Dr. V. P. Gibney would make me hesitate to differ with him in opinion. He will, however, enjoy with me the humorous element which comes to light in his having referred to the wrong boy in his argument in favor of operating for the correction of these deformities. In giving the previous history of one of the cases in which he had operated with excellent success

FIG. 1

FIG. 2.

CASE I.—Duration of disease before treatment nineteen months. Under treatment two years, five months. Photographed in 1879, six months after treatment. Age, nine years.

he says: "Dr. Judson finally succeeded in arresting the disease, presenting his case as cured in a series reported in Vol. II of the *Transactions* of the Academy."[1] This boy was badly deformed, with good reason, as will appear further on, but he was not in the series presented to the Academy. The patients so presented had recovered with but little flexion and adduction. Their condition soon after treatment and twenty years later is shown in Figs. 1, 2, 3, 4.

[1] TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, vol. vii. 1894, pp. 195–197; The International Medical Magazine, November, 1894, vol. iii. pp. 713. 714.

The boy on whom Dr. Gibney operated was described by me on another occasion as showing bad deformity, the result of careless walking, in the following words. In the same connection I referred to two other patients who had avoided deformity by walking symmetrically. I reproduce the whole passage, substantially as follows:

FIG. 3.

FIG. 4.

CASE I.—Photographed 1899, twenty years after treatment. Age, twenty-nine years.

"Why do patients similarly affected and treated exactly alike recover with such different degrees of deformity? A young girl, for instance, was in the third stage before treatment was begun, in May, 1880. She has recovered with no adduction, almost no flexion, and with very little lameness. I attribute this good position to the fact that her mother was very anxious about her only daughter and was always with her, so that every step the child took, wearing the hip-

splint, was taken under the necessity of appearing as well as she could. Her steps were timed equally, and her affected limb assumed and retained a useful position, because it had to do, so far as was possible, one-half of the work of locomotion.

"A boy recovered (treatment begun June, 1883) from the disease in a more moderate form, but he limps about most awkwardly, with

FIG. 5.

FIG. 6.

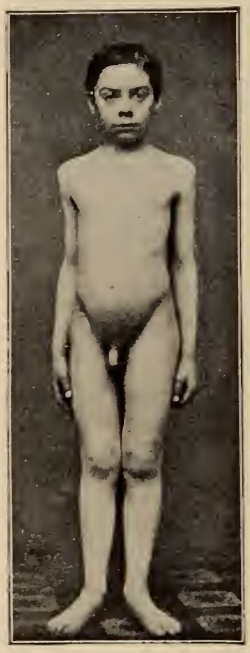
CASE II —Duration of disease before treatment one year. Under treatment two years, seven months. Photographed in 1880, eight months after treatment. Age, six years. Examined 1899, twenty years after treatment. Age, twenty-six years. Condition like that of Case III in 1899, excepting that there is one and a quarter inch of real shortening.

twenty degrees of adduction and fifty degrees of flexion. I explain his bad position by the fact that his mother, one of the best women in the world, was busy out of the house every day, leaving at home all day her family of four boys. As the patient was most of the time in excellent general health, he vied with his brothers in all their games, and developed his well limb at the expense of the affected one, which was elevated and adducted to keep it out of the way.

"In another case (treatment begun November, 1883) the patient, who recovered after long-continued purulent discharges, was a girl endowed with uncommon beauty, and although she was by no means docile, and under very little restraint at home, her vanity led her to try to appear to the best advantage, and, thanks to her careful gait and studied attempts to be graceful, she now walks with very little lameness, with flexion not more than ten degrees, and no adduction.

FIG. 7.

FIG. 8.



CASE III.—Duration of disease before treatment four years. Under treatment four years. Photographed in 1879, eighteen months after treatment. Age, thirteen years.

"I advise special attention to the manner of walking, insisting on the patient's keeping time in his steps, so far as is practical, and leading him to adopt a proud bearing. A girl is told to practice deportment before a looking-glass, and the parents are informed of the importance of encouraging the child to adopt deliberate and graceful movements on all occasions."[1]

[1] TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, vol. ii. 1889, pp. 181-183.

These views[1] have been but confirmed by intervening experience. Intractable cases will occur—exceptions, perhaps, to prove the rule—like that of the boy referred to. For him there was no resort except to operative correction, which was well done by Dr. Gibney, as shown in the photographs which form a part of his valuable paper.

FIG. 9.

FIG. 10.

CASE III.—Photographed 1899, twenty-one years after treatment. Age, thirty-three years.

The series referred to, showing the results of treatment in severe cases, was reported to the Academy in April, 1880.[2] Their condition at that time and also twenty years later is shown in the figures, so far as photographs could be obtained. These patients were all ad-

[1] See, also, St. Louis Courier of Medicine, May, 1881, vol. v. p. 372; Medical Record, May 21, 1887, vol. xxxi. p. 586.

[2] Illustrated Medicine and Surgery (Fox's Quarterly), New York, April, 1882, vol. i. pp. 45–52. See, also, Medical Record, October 28, 1893, vol. xliv. pp. 545–548.

vanced in the third stage in its worst features before treatment was begun, and their recovery was something in the nature of a surprise. In fact, the series would have contained four cases if a patient similarly affected and under treatment had not died of tubercular meningitis.[1] The method is applicable as well to cases of moderate severity, a number of which were reported in the *American Medico-Surgical Bulletin*, January 1, 1895, vol. viii. pp. 4–6. In orthopedic charities, where patients equipped with the ischiatic crutch might be formed into companies, military drill would doubtless do much toward securing a final good position of the limb, remembering that complete success will depend largely on an exact adjustment of the apparatus. In cases of recovery with normal motion in the joint the question of the management of deformity is happily shut out.

[1] Medical Record, May 1, 1880, vol. xvii. pp. 490, 491.

THE CONSERVATIVE SURGICAL TREATMENT OF TUBERCULOUS DISEASE OF JOINTS.

By CLARENCE L. STARR, M.D.,
TORONTO.

In presenting this paper, it is not with the desire to establish a surgical principle applicable to all cases of disease of bones due to tuberculous infection, but it is more to present the results of treatment in a few cases and to elicit the opinion of the members of this Association as to whether better results could not be obtained if surgical interference were resorted to oftener in selected cases. Fully 50 per cent. of tuberculous joints, according to the statistics of a number of observers, are primarily osseous in origin, and of these the focus of disease may be located fairly accurately in the larger number. This focus tends to extend, and in a varying time, in the vast majority of cases, opens in the joint-cavity, and a general arthritis results from what was primarily a tuberculous osteomyelitis. A correct knowledge of the pathological anatomy is necessary, in order that the surgeon may successfully treat, by direct surgical means, this tuberculous lesion of bone. Too many surgeons are content to remove only the disintegrating, carious portion of the diseased bone, not realizing that in the inflammatory zone around about the microbic cause of the trouble is even more active than in the detritus removed. Owing to the laborious researches of Virchow, Klebs, Köster, Friedländer, Koch, and many others, we now understand fairly accurately the process of development of tuberculous disease in bony tissue. The tubercle bacillus is the "corpus delicti," and it having a special predilection for the red medullary portion of the cancellous tissue in the epiphyses of long bones, lodges there, and a tuberculous inflammation commences. This affinity of the bacillus for the red marrow probably explains the reason why tuber-

culous infection is uncommon at the two extremes of life. In the infant the marrow is too vascular, and in old age there is the fatty condition existing. The tuberculous product resulting from the inflammation shows first as a submiliary, microscopic nodule formed of leucocytes escaped from a neighboring capillary, damaged by the tubercle bacillus; and other new cells, the result of pre-existing cell proliferation. These nodules become confluent, and a visible gray tubercle is formed, a still further coalescence takes place, caseation ensues and a general breaking down of the mass. The histological elements which go to make up the tubercle are the giant-cells, the epithelioid cells, and the leucocytes. The giant-cells are probably hyperplastic epithelioid cells, and are usually situated in the centre, with the epithelioid cells, which are the result of the proliferation of already existing cells, surrounding them, and leucocytes as an outer zone. The presence of the leucocytes is proof-positive that an inflammatory action is going on and that at the periphery of the nodule. Bacilli, when found in a tuberculous lesion, are found either in or between the epithelioid cells, and, what is of more importance to the surgeon, never beyond the inflammatory zone. Few if any are found in the detritus after caseation has taken place, although inoculation experiments prove that the detritus still has power of conveying infection, probably owing to the fact that the spores remain active. There being no vascular supply to the tubercular inflammatory product coagulation necrosis ensues, followed by caseation. This starts first in the giant cells and extends to the epithelioid cells from centre to periphery, always keeping an inflammatory zone on the outside. This inflammation accounts for the lengthening of bones in early cases of tuberculous infection of the epiphysis. The inflammation extending to the epiphyseal line causes an increased blood-supply and consequent stimulation of the osteoblastic cells. The tuberculous osteomyelitis continuing, is followed by caseation, the epiphyseal line is finally destroyed, and growth stops. After the caseous cavity has formed spontaneous cure is still possible by encapsulation of the cavity, with a calcified wall, but more often the disease continues and travels toward the joint, followed by an escape of tuberculous material into the joint and a general osteo-arthritis. In some cases the joint may escape, the disease extending toward the surface and opening through the periosteum outside of the capsule.

The question now is raised as to whether one can diagnose accurately a tuberculous focus in the epiphysis of a long bone before the joint is affected. In this one must be guided largely by the local symptoms. Pain is not a prominent symptom in tuberculous affection of bones, and often is not referred to the seat of disease. Tenderness is a more important symptom. If the focus of disease is located sufficiently close to the surface the inflammatory zone extends to the periosteum and a localized periostitis is set up, and consequent tenderness at that point. If the focus is centrally located the periosteum may escape and no tenderness is discernible, but usually the focus is located close enough to give rise to some tenderness. This point should never be overlooked as it is of great importance, not only from a diagnostic but also from a therapeutic stand-point. Along with the tenderness there is more or less swelling, or at least thickening, of the tissues at the focal point when compared with the opposite joint. Often in obscure cases the diseased focus may be detected by puncture of the supposed point with a sharp-pointed instrument.

We also have now a very accurate means of diagnosis by means of skiagraphs, where even a very small focus can be located. By this means, also, we can determine whether the cavity left after treatment is filled with bony tissue or only with fibrous tissue.

Having a complete picture of a tuberculous disease of osseous origin, the treatment indicated seems plainly to remove by mechanical means the diseased focus as soon as a positive diagnosis of the focus is made and before the joint is involved.

If the osseous focus is not too close to the adjacent joint it may be exposed with a chisel after cutting down on the bone through the periosteum, and then the caseous material may be thoroughly scraped out with a sharp spoon, flushing at the same time with sterilized water to remove all detritus. Remembering that the bacilli are most frequently found in the epithelioid layer and inflammatory zone, the operator should not cease until this is all removed and healthy solid bone is felt in all directions. If in doubt as to whether all the infected area is removed it would seem indicated to swab out the cavity with pure carbolic acid or zinc chloride, in order to reach any remaining bacilli. The cavity should then be filled with iodoform emulsion and packed with gauze, afterward applying an antiseptic

dressing. If the focus is close to the joint the periosteum, with the attached capsule or ligaments, may be elevated and the bone chiselled out as before without opening into the joint. By early and thorough removal of the diseased tubercular focus one hopes to accomplish two things—the prevention of general infection from the local focus and the limiting of the disease—and a consequent cure in a shorter time than can be hoped for by mechanical means.

The writer desires to report a few cases treated as described above.

Case I. L. M., aged five years, came under my care August, 1897, with tuberculous disease of the spine. In September showed signs of commencing ostitis of left knee, lameness, with some pain on walking, stiffness, etc. Toward the end of the month a distinct tender point was noticed over the inner tuberosity of the tibia, with some thickening and aching pain. No apparent involvement of the joint structure.

November 3, 1897, an incision was made over the tender point, the periosteum, which was found thickened, was elevated, and with a chisel an opening was made at once into a caseous focus, through a thin shell of bone. The cavity, about the size of a small walnut, was thoroughly scraped, flushing it at the same time with sterilized water until solid free bone was reached; cavity then swabbed with pure carbolic acid, filled with emulsion of iodoform and glycerin and packed with iodoform gauze, antiseptic dressing applied. Wound dressed in one week, packing removed and cavity dry, drain left out and wound allowed to granulate. Healing went on without interruption, and all tenderness and ache disappeared. Wore Thomas splint for three months, during which time no acute symptoms developed.

March 14, 1898. Has no symptoms of knee trouble, and walks readily without pain, tenderness, or stiffness. Splint left off.

May 20, 1899. Patient still free from any symptoms of knee trouble, walking freely, no limp, pain, or tenderness.

Case II. E. K., aged nine years, first seen December, 17, 1897; had complained of pain in right ankle in the morning for two or three months, with limp, which has gradually increased until the present time. On admission had distinct limitation of motion of

ankle-joint, there being not more than ten degrees of motion, with thickening of lower end of tibia over internal malleolus. This point was also quite tender on pressure, and a constant ache was present.

January 3, 1898. Incision made over tender point, periosteum elevated, and with a chisel opened into a cavity. This was thoroughly scraped until healthy bone was felt in all directions, an opening of about the size of a large hazel-nut resulting. This was flushed and swabbed with zinc chloride, forty grains to the ounce. Then emulsion of iodoform injected and wound closed entirely without drainage.

January 28, 1898. Dressing not disturbed until the present date, when wound is found solidly closed. Thomas knee-splint applied.

March 13, 1898. Still wearing splint. No ache or tenderness; some stiffness at ankle, walks stiffly.

May 4, 1898. No tenderness or pain on movement, splint removed.

May 20, 1899. Been walking since last note; no recurrence; ankle not free, but no pain or sign of active disease.

Case III. C. P., aged eleven years, first seen October, 1896. Had been treated for rheumatism for four or five months previously. Condition showed marked thickening of external condyle of femur, little if any tenderness, but considerable pain and stiffness of joint.

November 4, 1896. Incision was made over external condyle posterior to capsule of joint, periosteum raised to avoid opening joint cavity; an awl was sunk into the bone, and after two or three attempts a cavity was found. An opening was made with a chisel, and a cavity the size of a small hen's egg was scraped out, flushed, treated with pure carbolic acid, packed with iodoform gauze, and dressed antiseptically.

November 14, 1896. Wound dressed, clean, packed loosely.

January 20, 1897. Wound discharged slightly for few weeks, but gradually healed, leaving small sinus.

February 10, 1897. Sinus closed; discharged, wearing Thomas splint.

May 20, 1899. Did not hear from this boy until about six weeks ago, when he stated that the splint was left off in July, 1897, because

it became too short. Been walking without support ever since. Now has no pain, no limp; knee shows slight thickening compared with the other knee, but shows no sign of active disease.

In addition to these three cases I desire to report two more under the care of Dr. Primrose, of Toronto, in which I assisted at the operation.

Case IV. F. E., aged fourteen years; admitted November 20, 1897; family history negative. About six months ago the knee began to pain, some swelling and slight tenderness; kept in bed until March 24th, when Dr. Primrose made an incision on the tuberosity of the tibia by means of a chisel. He opened up the bone and removed a considerable amount of caseous material and necrotic osseous débris, and then scraped away the cavity until firm bone was obtained. The cavity was then swabbed with zinc chloride, forty grains to the ounce. Then iodoform emulsion injected, and the wound stitched with horsehair, back splint with foot-piece applied.

March 30th, removed stitches, wound healed, no swelling, no pain, entirely lost the ache which she has had for several months.

April 15th, dressed for the second time, wound completely healed, no swelling, no pain.

May 31, 1898. Seen to-day, knee in good condition; goes to England wearing Thomas splint.

May 23, 1899. Patient wore splint until October or November; been going about ever since, although not actively using joint; no signs of any recurrence. About one month ago wrote to know if she might dance, as there was no pain or bad symptom of any kind.

Case V. E. W., aged twelve years; admitted January 13, 1898. Has had symptoms of tuberculous disease of the knee for eighteen months past, sinus in the popliteal space.

April 7, 1898, sinus cleaned out and packed, small piece of carious bone removed; knee shows no swelling, although considerable thickening in lower end of femur, no synovial thickening. There is one inch of shortening on the diseased side, the bone found inflamed and softened, easily scraped out with a sharp spoon, a portion of carious bone found over femoral epiphysis. This was removed until firm walls were felt, the cavity then flushed with sterilized water,

washed with zinc chloride, forty grains to an ounce, packed with iodoform gauze and back splint applied.

April 21st, wound dressed, packing removed, antiseptic dressing applied.

Discharged June 13, 1898. Wound healed, no tenderness, walks well, apparently cured. Have been unable to make final note, owing to the fact that this boy's address is lost, but as he was told to report if any recurrence took place, we surmise that he is still in good condition.

DISCUSSION.

Dr. Weigel said that the paper of Dr. Starr seemed to follow out the fairly well-established principle that disease could be shortened when one was able to eliminate the focus. This elimination had been somewhat difficult except in a few isolated cases. One was apt to be misled as to the exact location of such a focus. He had demonstrated that it was possible at the present time to localize a tubercular focus, and hence the outlook was proportionately more favorable. He had practised this conservative treatment for a number of years, and had always been gratified with the results.

Dr. McCurdy said that it was interesting to have the subject of disease and joint deformity presented so thoroughly and systematically as in Dr. Sherman's paper. One point there brought out had been somewhat neglected by the general profession—*i. e.*, the difference between limited motion and rigidity. The limitation of motion might be due to various things, but the rigidity was the result of tubercular disease.

Dr. Wirt said that he had understood Dr. Sherman to say that he considered that there was no real muscular spasm. He did not quite understand this position, and would like some more definite information on this point.

Dr. A. B. Judson said that he had understood Dr. Sherman to eliminate the reflex action of the muscles as an agent in deciding

what the deformity would be, and to this he would agree. Reflex muscular action could not be entirely eliminated, however, as it was this, in his opinion, which produced arrest of motion or fixation. To his mind the position the limb would take was decided by what was most convenient to the patient, meaning by "convenient" the absence of pain, among other things. Thus in hip disease there was very early abduction, because the patient found that it was most easy to avoid the traumatism by standing on the well limb and abducting the affected limb. Later on, when considerable walking was necessary, convenience was sought by elevating the pelvis and abducting the limb, producing some shortening. In the third stage convenience was found in the recumbent position by extreme adduction and flexion.

Dr. Steele said that he was not yet convinced that the muscles did not play the most important part in the deformity resulting from hip-joint disease. After a more thorough study of Dr. Sherman's paper he might accept that writer's conclusions, but he was not yet prepared to throw aside muscular spasm, for the muscles were contracted and the tendons were found standing out rigidly, and by extension almost immediate relief could be given. Traction would cause more tension of the ligaments, to which reference has been made as being the cause of the pain, and so increase the trouble. Are we to throw aside all past experience in the treatment of joint disease by traction? He did not agree with Mr. Thomas in the folly of traction, and that the hip-joint could be properly immobilized by a portable splint; hence, he was in favor in the early stage of hip disease of putting the patient on a portable bed or stretcher, so as to secure proper immobilization plus traction, and at the same time give sufficient fresh air and sunlight. When there was no longer contraction of the muscles, then it was time to apply Mr. Thomas' splint. Perhaps we might all get as good results as does Dr. Judson if we had the same sweet temper, time, and patience.

Dr. Whitman said he had been very much interested in Dr. Sherman's paper, but he thought the author should have paid more attention to habitual use in the final production of deformities. For instance, outward rotation and backward dislocation of the knee

were more likely to follow as a result of using the limb than when it had been protected or had not been walked upon. Dr. Sherman seemed to limit himself too closely by explaining attitudes by the pain and weakness of bone disease. Dr. Whitman said that some years ago he had called attention to the fact that the attitudes caused by paralysis of cerebral origin were very similar to those caused by joint disease. From this point of view he had endeavored to explain distortion. From the stand-point of evolution, that in the strain put upon the human frame by the upright attitude was very much more difficult than in the lower or quadrupedal portion; and when, for any reason, the control of the joint was taken away, or when it was unfitted for the work, the difficult attitude by extension was replaced by habitual flexions. Flexion was constant in all joints; other distortions were less regular, and were caused by a variety of circumstances.

Dr. Davis said that he thought the operative treatment of hip-joint disease was likely to be a more prominent question in the next few years. The position of the English surgeons some years ago, favoring early radical operation, had been largely discarded; but there were many conservative operations intended to prevent the further development of the disease. Macnamara, in his book on *Bone Affections*, published some years ago, had advocated trephining the bones. This operation, the speaker said, he had performed in several cases. For instance, if a tubercle process could be located in the lower extremity of the tube a number of holes would be drilled at the supposed seat of the disease, and this operation would apparently stop the disease. He was inclined to adopt the proposition that in all cases in which there was a sinus the latter should be dilated and an effort made to find the focus.

Dr. Judson spoke of the mobility of the immobilization in hip-joint disease. He was inclined to believe that for long periods in the disease it was wrong to say that the joint was "fixed." He would not be surprised to find a child with abduction after standing for a long time in a position "at ease," and after lying in bed for a few hours to find that the abduction had given place to adduction, in obedience to the tendency to arrest of motion by making a splint of the well limb.

Dr. Ridlon criticised the splint presented by Dr. McKenzie. It was evidently intended to immobilize and produce traction. The material used in it did not have sufficient rigidity, and was not suitable for the construction of a Thomas splint. A splint built on the principle that this one was should not "spring." It was impossible to fit such a splint accurately to the patient. If the bar had been made twice as thick and one-third narrower, it would have had less "spring."

Dr. Sherman said, regarding his statement, that there was no muscular spasm *per se*—that at the beginning of a tubercular process there would be an inhibition of full extension. At the same time, if the joint were examined, it would be found that full flexion had been inhibited also. As the tubercular process went on the inhibition of both motions would increase until both inhibited arcs met and immobility resulted. The joint was held in this way not by spasm, but by tonic contraction in obedience to a reflex impulse through the cord. A little carelessness on the part of any portion of this organism during sleep, for instance, would permit of slight motion of extension into an inhibited arc, with symptoms of pain and an instantaneous response on the part of the flexor group to remove the muscle from that inhibited arc. That motion might be so powerful as to carry the limb past the point of selection and into the inhibited arc of flexion. Then the flexors would respond, and in due time the limb would get into a proper position. This action was not a spasm *per se;* it was not convulsive; it did not originate in the muscle like a cramp; it was excessive motion in response to reflex stimuli. That was what he had meant by saying that there was not a definite spasm—it was a tonic contraction.

Regarding the muscles being implicated, they certainly were implicated, but only secondarily—only as the servants of the bone and of the spinal cord—their action was never initiated in themselves. The position assumed was the one in which the limb was kept away from the arcs of greatest efficiency, and consequently it was limited to the position of least work. The idea at the beginning was, that, as the only lesion was in the bone, one must look to that lesion for the motive. All the other parts of the organism being normal, the motive would be to use the other parts as the servants of the affected

part. Later on, when there had been an extension of the pathological process, there would be complex motives and a complex result. The final position would be the result of these different stimuli. He did not recall having read Dr. Whitman's paper at the time of writing his own.

He had been greatly interested in Dr. Starr's paper, for it presented a most attractive notion of the early treatment of joint disease. The idea seemed to him thoroughly logical and progressive, and he had already put it in practice, but was waiting for final results and more accurate observations, including those obtainable with the aid of radiographs. He wanted to see whether the hole would fill up with bone or with scar tissue. He did not like the dressing employed by Dr. Starr, for where there was no mixed infection he did not see any occasion for any germicide. He did not believe iodoform killed the bacillus of tuberculosis, and iodoform must itself be sterilized, otherwise its introduction into a wound in the form of powder would mean the introduction of a good deal of extraneous matter, which might or might not be harmful.

Dr. McKenzie said that he had been troubled constantly with the breaking of splints, and consequently he has made them strong and as light as possible commensurate with strength. As to the fixation of the hip-joint produced by the splint, he would say that it secured approximate fixation, the amount depending upon the length of the lever employed.

It had been his practice for some time to deal with the foci of disease that could be located in the ends of the long bones as early as practicable, and according to the general method described by Dr. Starr. Quite recently he had had a marked case of this kind occurring in the lower end of the femur. The peculiarity of the splint exhibited was that counter-traction was made on the side *opposite* to the disease.

He wished also to express his warm appreciation of the paper presented by Dr. Sherman. After more thorough study of it he expected to be in a position to indorse most of the views there expressed.

Dr. Starr said that he did not consider the iodoform of any particular advantage, and had employed it more as a matter of rou-

tine in the treatment of sinuses. The swabbing of the cavity with pure carbolic acid or with chloride of zinc he considered to be a very essential part of the treatment. He believed that the cavity would fill up with true bony tissue and not scar tissue. As in nearly all sinuses there was practically a mixed infection, one should endeavor to prevent this by early operation.

JOINT INFECTION IN TYPHOID FEVER.

By CHARLES W. WILSON, M.D.,
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Of more than usual interest have been a few cases which have come under my observation within the last year. These represent a condition concurrent with, or a sequel in, the convalescence from typhoid fever. Although the lesions due to typhoid are many, in this paper joint affections only will be considered, being of special interest to the orthopedist on account of the deformities accompanying them, the necessity of forestalling these when the liability to them is shown by pain, swelling or some other feature drawing attention to the joint, and of correcting and re-establishing their usefulness when the deformity of the joint has already occurred.

Although the typhoid bacillus—the bacillus of Eberth—has been found in the joint fluids in a few cases, it is not usually; beside, typhoid joints have seldom been examined post-mortem, and there are very few records of bacteriological examination, and these have been either negative or reveal the presence of pyogenic organisms. Prof. Keen recounts a number of interesting cases with regard to this point. Orloff injected cultures into joints of dogs and rabbits, and reported that this was followed by swelling in twenty-four hours, with hemorrhage in the synovial membranes. A thick, tenacious, turbid fluid was produced in the joints, which later became purulent. There were found no pus-corpuscles, but in the earlier days after the infection typhoid bacilli. This may explain the impossibility of finding the bacilli in the joint affections in man, at least in some cases — having done their malign work they have disappeared. Though we are still ignorant of the bacteriology of joint effusions, from analogy we may conclude the primary invasion by bacilli, then disappearance of these. "The irritation caused by the bacilli

or their toxins will readily account for the slow but steady accumulation of fluid in the joint" (Keen).

When the pyogenic bacteria, staphylococci and streptococci are present we have what is called mixed infection, and where abscesses result the typhoid bacillus is found more about the walls of the abscess cavity than in its contents. The fact of joint affection being so often formed in or after typhod, at shorter or longer periods, is presumptive evidence that if not responsible directly for the joint inflammation the typhoid bacillus is strongly contributory to it, in lowering the general resistance and allowing infection by other forms of bacteria to occur. This condition may be induced by slight injuries, the use of the joint when in a weak condition, predisposing a favorable state for the attack of the bacillus. Case III shows the pain and joint trouble coming on five days after rising from bed, apparently recovered.

What is the nature of the joint trouble? We are familiar with the frequency of periostitis most commonly, and osteomyelitis, in the bones, following typhoid, but the exact nature of the joint affection is not well understood. Sometimes the joints are infected by an extension into them of the above-named conditions, still primary infection is the rule.

Prof. Keen, of Philadelphia, whose recent work (*Surgical Complications and Sequels to Typhoid Fever*) embraces a chapter on Joints, has contributed the most complete and exhaustive treatise on the subject up to the present time. He also sums up the literature most comprehensively, and the clinical classification which he makes is a very satisfactory one. He speaks of typhoid arthritis proper, and beside this form, rheumatic typhoid arthritis and septic typhoid arthritis. The rheumatic variety is well illustrated by the following case:

Case I. F. Q., aged twelve years (Montreal General Hospital), who exhibited multiple ankylosis, commencing late, after an illness, presumably typhoid, one year. When a child of seven she received a kick in the ankle, in the month of May; was stiff a few days only. As late as August no signs of trouble; then joint began to swell; in two months the knee of the same side was involved, and contraction began to take place. Was put in plaster-of-Paris; remained

some time, and when removed was said to be all right. Then, some time afterward—namely, four years ago—the other foot and knee gave trouble, and both hips. She was put on an extension and kept straight, on a wheeled carriage, for a year and a half; then allowed sitting up, when spine, shoulders, elbows, and wrists were found involved.

She came under my charge in the Montreal General Hospital last spring, after being without treatment for some four months, during which time she was allowed to sit up in a chair; and from this bad position became much deformed, flexions of knees, hips, elbows, wrists, spine, and wry-neck, the ankles also. There is strong fibrous ankylosis in these positions, and pain on attempted passive motion, but no osteophytic growth nor apparent aberration of the joint surfaces. By Billroth splints and traction in the line of deformity on a frame nearly all the deformity had been overcome; but ankylosis persists and forcible movement sets up fresh arthritis. We have used the hot-air baths for some months, up to 325°, but stopped them, as no appreciable benefit was observed. The patient is in good health otherwise.

Typhoid arthritis proper, illustrated by Cases II and III. This variety may be either polyarticular or monarticular, the hip being the joint generally attacked in the latter instance, and being the most serious in its results. These cases are rarely fatal, and recover with very little deficiency of the joint. Ankylosis is not usual as a result. Faulty positions persisted in for a long time after the fever disappeared accounted for the ankylosis in both hips in one of the cases quoted by Prof. Keen. This was removed by forcible flexion, under ether, so that in a similar case early passive motion is indicated.

The monarticular form affects the large joints, the elbows, shoulder, ankle, knee, but especially the hip at first (Cases II and III). Early pain and incapacity, swelling, heat, and redness, although the swelling may be concealed or masked by the large muscles about hip, and contractions are found in this form. These contractions interest us most, as we have to deal with the deformities, generally after the fever has disappeared some time. The condition here is one of synovitis with consecutive arthritis, but pus is infrequent and

fistulous openings rare (Keen). In only one case out of forty-one given by Keen in his second table did suppuration occur, and that was in the knee. Dunin's case, also quoted, in which there were abscesses of the buttock and hip, many furuncles and suppurative otitis media, with arthritis of the right elbow and shoulder; these joints did not suppurate. In this class of cases useful joints generally result (Cases II and III).

As to frequency in typhoid of these joint troubles, it is not great. In the literature of the last fifty years, Keen has collected in all eighty-four cases involving the joints, in which he says spontaneous dislocation occurred in forty-three—forty in the hip, twice in the shoulder, and once in the knee; so that fully one-half of all cases of typhoid arthritis are followed by spontaneous dislocation, nearly all of which were of the hip-joint.

Dislocation is a most important feature in this form; it is similar to that found in exanthematic arthritis, Charcot's joint, etc. The cause of dislocation is a subacute synovitis, distending the capsule, which, reinforced by the Y-ligament anteriorly, gives way or stretches posteriorly, then stretching of the ligaments from the same cause, and filtering of the fluid between the articular surfaces. After the subsidence of the inflammation, on account of the looseness of the capsule, and perhaps of the thickening of the gland at the bottom of the acetabulum, the muscles by contraction will dislocate the joint, or it may be turned out by any small force, as turning in bed. Iliac is the usual form, although obturator dislocations have been reported. "As to sex: Of thirty-five cases, nineteen were males and sixteen females. Age: Thirty-two out of thirty-five occurred before the twentieth year." There is a very marked analogy to coxalgia, and diagnosis is therefore important. The treatment of these cases is simple, if early; but late, is sometimes very troublesome. In seventeen cases reduced, thirteen were by manipulation, two by both. In eleven cases reduction was not effected. If one finds pain in a joint in a case of typhoid use every precaution (x.). Rest position in abduction and external rotation, sand-bags, and mild extension are recommended by Keen where a hip is involved. If effusion is great, aspirate strictly antiseptically; if pus is found, open up and treat antiseptically. Sometimes necrosis is found.

The third class of case is that of mixed infection, due to infection

by typhoid and pyogenic bacteria. This condition may be very serious indeed. Infection may take place from bed-sores (Case IV), boils, ulcers, and even typhoid ulcers themselves. It is usually polyarticular; the symptoms are those of acute suppurative arthritis, but more severe. Death may occur from septic absorption within a few days, or rigors and a succession of chills be experienced; high temperature, 105° and 106°; bounding pulse, soon becoming weak; tongue, dry and brown; sordes, delirium, and death from poisoning. This requires most vigorous treatment, free incision and drainage to save the joints and life—the earlier the better. If synovial membrane is not all destroyed, a certain degree of motion may be re-established.

In mild cases of ordinary typhoid arthritis, elevation, with cold and compression, light diet, and bowels kept open, with rest, is sufficient. Differentiate this condition from other forms of joint trouble —simple arthritis, suppurative arthritis, puerperal, pyæmic, exanthematic, gouty, rheumatic, urethral, osteo-arthritic, tubercle arthritis, and senile tuberculosis.

The contractions in these cases are due to reflex muscular contraction due to joint irritation. Faulty position certainly assist.

Typhoid bacillus infections occur usually late, the mixed early in convalescence.

Case II. A. J., aged nineteen years, student, taken ill with typhoid fever January 2d of this year; delirious three weeks, then progressed favorably for a time, when the high temperature recurred of an intermittent type. He became convalescent and got up and about; in two weeks he had to take to bed again, with pain in the right hip-joint and flexion of the thigh upon the abdomen. Rest in bed one week only, with the use of hot-water bag, brought about a subsidence of pain, and the contraction relaxed. Pain was referred to the right thigh and testis, although no inflammatory trouble existed in the latter organ. Is now up and about again (May 1st), but still has contraction of right hip-joint; cannot be extended beyond 180°.

Case III. X., aged eleven years. On January 23d of this year was called in consultation to see a young girl who had had typhoid

fever—a mild attack, commencing October 3, 1898. She remained in bed two weeks; was then allowed up, and after five days complained of a sore leg, returned to bed, and then drawing up of the limbs took place (both lower extremities), and this continued up to the time I saw her. She then laid in the recumbent position, hips and knees flexed—hips about 90°, knees about 45°; left adduction marked, with abduction of right thigh; apparent shortening of left thigh two inches—rather greater than the adduction should indicate; tenderness in the region of the left hip was great, but not marked in the right hip or knees, which were rigid but movable. She was very apprehensive. Chloroform was given, to more fully examine the joint, and it was moved about rather more than was necessary or advisable. Under the anæsthetic the limb could be fairly well moved through a limited range of motion; thigh flexed on abdomen and extended to about 135°, excluding any great degree of dislocation, although such presented itself to my mind by the position and measurement of the limb, Nélaton's line being from one-half to three-fourths inch below the border of the great trochanter, but in the flexed position there might have been a slight error; however, dislocation was suspected at this time. Another feature of this case was the presence of a muscle tumor (receding myostitis) or hæmatoma in the anterior femoral region, just below Scarpa's triangle. Typhoid joint was diagnosed and treatment by extension in the lines of the deformity advised. While preparing the Bradford frame, and upon return visit, the thighs were found drawn up upon the abdomen and markedly tender and painful, due to the movement in examination, proving to myself joint affection as the cause, the increased flexion being due to muscular contraction consequent on the aggravated synovitis or arthritis.

Treatment was applied; aspiration was opposed by the parents. Extension by weight and pulley was applied to both thighs in the line of deformity by means of a scaffold over the bed, and elastic traction by rubber tubing and ankle boots attached to the end of the Bradford frame, on which the patient was placed. The synovitis and arthritis subsided nicely, and the contractions relaxed rapidly, until February 9th, two weeks later, the temperature was normal, pulse 60, the thighs about 135°, knees 90°. A double inclined plane with joint at the knees was then attached and traction continued both

from thighs and legs, with weight and pulley, until both limbs came down quite straight, as far as knees and hips were concerned. The adduction, however, was obstinate, but was overcome somewhat by traction and counter-extension. It was then easily seen that the left limb was shorter, and with anterior superior spines as a point of measurement the left was three-fourths of an inch shorter than the right. Was this subluxation or absorption of the head of the bone? The child being very nervous and apprehensive of pain, it was impossible to make examination by manipulation until almost the present time, but Nélaton's line relation to the trochanter still remained the same (three-fourths of an inch difference). Passive rotation was not possible—indeed, absolutely opposed or impossible—so that no arc of rotation could be estimated to compare with the other hip. Tenderness still remained, but was very much relieved.

The tendency to adduction and knee-flexion and foot-inversion, unless very carefully guarded against, confirmed my original suspicion of subluxation, and the X-ray picture of to-day (May 28th) shows distinctly a subluxation of the head upon the bone upward and backward upon the ilium.

The further treatment of this case is by a double Phelps hip-brace until all tenderness in the joints has disappeared; then passive motion, massage, and frictions. I shall make an attempt to replace the left hip-joint, and trust it may be successful.

The right ankle in this case early showed signs of trouble, and was put up in a plaster-of-Paris case at right-angles. This was removed after three weeks, but still rigidity and tenderness remained, and it was put up again and left until three weeks ago, when it was removed. There was no pain nor tenderness on manipulation, but rigidity persisted, and pointing of the foot from the contraction of the strong posterior tibial group—after the ankle had been in plaster some time—and consequent slight deformity, which will be corrected at once, and splint applied to prevent recurrence until the anterior group of muscles can hold their own.

Inflammation of the interphalangeal joint of the great toe (right side) also occurred, but subsided through rest and use of a splint. The child can now move the right hip voluntarily fully 30°, the left limitedly about 10°, both knees slightly. Another feature in this case was the peculiar infiltration and tenderness (deep) with œdema

about the knee-joints, both taking it on some distance above and below the joint; hardly a periostitis, but osteomyelitis was suspected and feared. These did not occurr at the same time, but followed on each other, and became so serious a matter that to secure rest they were put up in plaster for three weeks, by which time the trouble subsided. It occurred to me that attempted motion of the joint might have been the determining cause. Perfect motion is expected in all the joints but the left hip, in which I trust a good result also will be brought about.

Case IV. *Septic typhoid arthritis.*—A. M., aged nineteen years, was admitted to Dr. Armstrong's ward, Montreal General Hospital, May 11th. December 9, 1897. Had had typhoid fever some three months previously; been treated in a hovel in the country, and came into the hospital with scar-tissue covering the trochanters and sacrum. Had had bed-sores extensively, which laid bare the bones at these parts. The left hip was ankylosed in slight flexion; the right dislocated posteriorly, the right knee lying over the lower portion of the left thigh; both knees acutely flexed and ankylosed. In all these joints there was very slight motion. Of course, the patient was unable to stand or walk. Treatment was applied by extension, weight and pulley, similarly to the last case, and the patient walked out of the hospital on crutches on July 21st.

This was evidently an instance of mixed infection, and, like Prof. Keen's case, the bed-sores might have been the port of entrance.

ON PALSY OF THE INTEROSSEI IN TALIPES ARCUATUS OR PES CAVUS,

With a Note on a Congenital Deformity of the Muscles of the Hams.

By E. MUIRHEAD LITTLE, F.R.C.S. Eng.

It is generally held by neurologists that the peculiar claw-like deformity of the foot in which the first or proximal phalanges are extended and the second and third flexed is due to paralysis of the interossei and lumbricales, and sometimes of short flexors also.

Thus, Duchenne described the deformity, and attributed it to this cause, and Gowers (*Diseases of the Nervous System*, 3d edition, 1899) says: "If (the interossei and analogous muscles) are paralyzed the first phalanges are over-extended, sometimes even subluxated, and the two other joints are flexed, so that a claw-like form of the foot is the result. Without multiplying instances we may assume that the above represents the opinion of most neurologists. Orthopedists, on the other hand, are not agreed as to the influence and importance of the interossei.

Shaffer, in his paper on "Non-deforming Club-foot," published in the *New York Medical Record*, in 1885, describes the deformity, but does not refer it to palsy of the interossei.

F. R. Fisher, in his papers on "Paralytic Deformity of the Foot" (*Lancet*, 19, 1, 89, etc.), while he describes the claw-like deformity of the toes, does not mention the interossei.

Golding Bird (*Guy's Hospital Reports*, vol. xiii.) denies that paralysis of the interossei is the cause of the deformity.

Walsham and Hughes (*Deformities of the Foot*) write that in some cases of talipes cavus with clawed toes the interossei were reported to react, and in others not to react, to faradism or galvanism.

They figure a case of "Paralytic Talipes Equinus" (p. 263), with marked clawing, in which well-developed interossei were found on dissection.

Tubly suspends judgment until wasting and degeneration of these muscles can be proved by dissection (*Deformities*, 1896).

Bradford and Lovett (*Orthopedic Surgery*, 1890) say: "The origin of the affection (third form of pes cavus) is in a paralysis of the interossei and lumbricoid muscles and of those muscles which are inserted into the sesamoid bones of the great toe."

In the last edition of Hoffa's *Lehrbuch der Orthopädiochen Chirurgie* (1898) I cannot find any reference to palsy of the interossei.

Enough has been said to show that orthopedists are by no means agreed on this subject. Perhaps the reason is that palsy of these muscles has not an immediately obvious result such as follows palsy of the tibialis anticus, and in the adolescent and adult it is not easily detected, because the lateral movements of the toes affected normally by the interossei are lost in the majority of boot-wearing folks from disuse after comparatively few years.

Young children, however, generally possess the power of separating the toes, as babies may often be seen to do on their nurses' laps or sitting on the floor, and it is surprising that few or no observations bearing on this point have been recorded in cases of deformity.

The following brief notes of a case which came under my care in 1897, show, I venture to think, very clearly the existence and the effect of palsy of the interossei in a case of pure talipes arcuatus or cavus:

W. B., male, aged eleven years, was admitted to the National Orthopedic Hospital as a case of hammer toes. Family and previous history were negative.

His right foot presents the following peculiarities. The arch is markedly higher than in the left foot. The toes are clawed—*i. e.*, the first phalanges extended, while the second and third are flexed. The extensor tendons appear to be contracted. When he stands upon the foot the ankles are both inclined to yield inward—ankle valgus or in-ankle. The position of the toes of both feet, when at rest, is shown in the accompanying photograph (Fig. 1). He has perfect

control over the movements of the ankle. The knee-jerk is normal. There is no anæsthesia. When the boy, who is a bright, intelligent

FIG. 1.

Palsy of interossei.

FIG. 2.

Palsy of interossei.

lad, is told to separate his toes he does so as regards the left foot, with great vigor, the four outer toes being strongly abducted. The right toes present a marked contrast. Beyond some increased extension all his efforts to separate them produce no result. Fig. 2, from a photograph taken during a strenuous attempt to separate the toes, shows the contrast between the two feet. It will be noted that all four toes are *ab*ducted, implying contraction of the dorsal interossei and of the abductor minimi digiti. The three plantar and the first dorsal interossei also act briskly and bring the toes back into the position of rest. The boy has apparently already lost the power of lateral movement of the great toe from the use of boots, and, therefore, separation of the toes can only be effected by abduction. The associated action of the dorsal and plantar interossei may be plainly seen in the hand when all the fingers together are abducted or adducted.

In this case the absence of lateral movement on the deformed side and its presence on the other, together with the absence of palsy of the long muscles, justifies the conclusion that there is palsy of the interossei, very probably accompanied by palsy of some of the other short muscles of the sole of the foot.

Since then I have frequently observed a similar condition in children suffering from paralytic talipes arcuatus of one side. Some children, however, lose the power of lateral movement from disuse early, and, therefore, it is not safe to diagnosticate palsy of interossei, from the fact that the power of separation is absent in one foot, unless it is present in the other.

That all cases of so-called clawed toes are necessarily cases of palsy of interossei cannot be asserted in the face of such cases as the one a dissection of which is represented by Walsham and Hughes (*op. cit.*, p. 263); but there are two forms included by orthopedists, at least, under this term—the true claw, such as in the case of W. B., in which the second and third phalanges are both flexed, as described by Gowers, and the other in which the third phalanx is markedly hyperextended, as in ordinary hammer-toe (in which the flexor tendons are adaptively shortened without paralysis of any muscle). This form of clawed toe occurs in talipes equinus from paralysis of the tibialis anticus, and may well be produced by the attempt of the

elongated and weakened extensors to perform the function of the tibialis in dorsal flexing the ankle and opposing the calf muscles. At the same time they are not able to fully extend the toes, owing to the tonic contraction of the healthy flexors. It is probable also that in some of these cases the interossei also may be palsied, for the effect of the extended (plantar flexed) position of the ankle, in causing extenion of the last phalanx when the patient walks, must not be overlooked.

FIG. 3.

Palsy of interossei and abnormality of ham muscle.

Only those cases, therefore, in which both the second and third joints are flexed can certainly be considered as due to palsy of interossei, unless, as before remarked, the power of separation of the toes is absent on the deformed side only. Clearly this test is inapplicable to cases of palsy on both sides, but the object of this paper is to point out that the lesion can often be detected in vivo without

the aid of electricity by means of volitional contraction of the muscles of the sound as compared with the deformed member.

The patient, W. B., presented also a curious congenital abnormality, which, although unconnected with talipes arcuatus, seems to me rare enough to be worthy of record.

FIG. 4.

Palsy of interossei and abnormality of ham muscles.

On examining the calves and back of the thighs it is found that the usual hollow of the ham is not noticeable, the calf passing into the thigh without any depression to mark the situation of the knee-joint.

On causing the calf muscles to contract nothing peculiar is noticed, but when at the same time the knees are flexed a strong rounded

cord starts into prominence rather to the outer side of the mid-line. This band below seems to be continuous with the outer part of the gastrocnemius; above, its termination is ill-defined, but it can be traced for some distance up the thigh, where it would seem to be attached to the posterior surface of the femur. Both limbs present this abnormality. It is a question whether this band is to be regarded, as has been suggested, as an extra insertion of the biceps into the fascia of the leg or as an origin of the gastrocnemius from the shaft of the femur, as occurs in some of the larger felidæ.

A photograph hardly does justice to the very striking appearance, but two are reproduced in Figs. 3 and 4.

SUBCUTANEOUS TENOTOMY.

Biographical Notes.

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In 1876, Dr. Louis Stromeyer (1804–1876) reached the fiftieth anniversary of his graduation in medicine at Berlin. The event was celebrated at Hanover. Mr. William MacCormac read the British address, which contained the following words: "Your discovery of a safe method of subcutaneous surgery forms an epoch in the history of our art"; and Dr. Little "made some remarks, thanking Stromeyer for having consented to sit for a marble bust,"[1] which was presented to the college at London, where it stands "among those of the most eminent British surgeons."[2] "Stromeyer denominated Dr. Little as the Apostle of Tenotomy, and ascribed to the visit paid him by Dr. Little the rapid diffusion of a knowledge of its happy results in Germany, France, and the United States."[3] "Never was any great operation, involving a vital principle of surgery, spread in less time over the globe, and with less resistance, than tenotomy."[4]

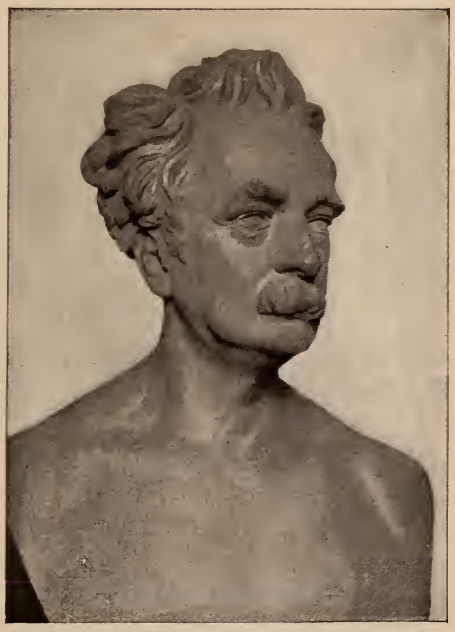
In 1829, at Hanover, Dr. Stromeyer "established a private orthopedic institution, and here, in February, 1831, he made his first section of the Achilles tendon. The operation marks the beginning of the whole system of subcutaneous surgery and, it may fairly be said, of all really successful orthopedic treatment."[5]

In 1836,[6] our late honorary member, Dr. William John Little

[1] Medical Times and Gazette, London, April 22, 1876, p 450.
[2] Proceedings of the Royal Medical and Chirurgical Society, London, 1877, vol. viii. pp. 179–182.
[3] Lancet, January 7, 1854, pp. 19, 20.
[4] Association Medical Journal, London, June, 29, 1855; new series, vol. iii. p. 603.
[5] Proceedings of the Royal Medical and Chirurgical Society, London, 1877, vol. viii. pp. 179–182.
[6] Ibid.

(1810–1894), visited Dr. Stromeyer at Hanover and—"unknown to his nearest friends in London, who would, he feared, have tried to prevent him had they known of his intention,"[1] and disregarding

Fig. 1.



the advice of many surgeons, of whom "none gave him help or hope"[2]—submitted himself to subcutaneous tenotomy for the relief of talipes equino-varus of the left foot,[3] "in which the sole was turned toward the opposite ankle,"[4] the result of an attack of infan-

[1] Lancet, July 21, 1894, p. 168.

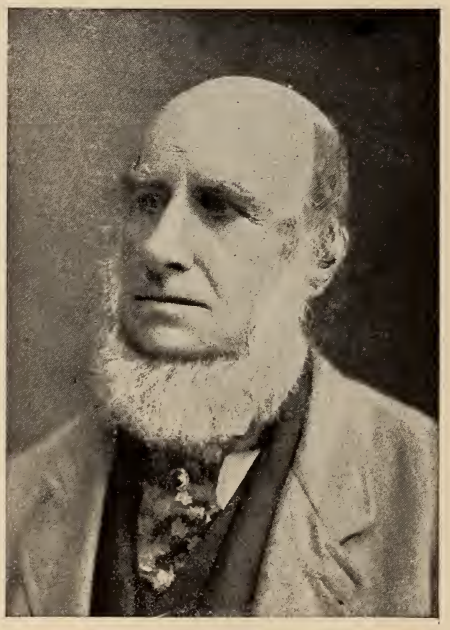
[2] Proceedings of the Royal Medical and Chirurgical Society, London, 1877, vol. viii. pp. 179–182.

[3] Lancet, July 21, 1894, p. 168.

[4] British Annals of Medicine, April, 1837; American Journal of the Medical Sciences, August, 1837, vol. xx. p. 513.

tile paralysis at the age of four years.[1] Up to the time of the operation he had worn instruments, "but could not walk many yards without pain." The result of the treatment at Hanover was satisfactory, and he was enabled to "walk twelve miles with pleasure."[2] "The benefit which he had received at the hands of Stromeyer laid

Fig. 2.



W. Little.

him under a deep obligation, both to that surgeon and to society at large, to devote his energies to the extension of the knowledge of tenotomy among the other scientific men of the day."[3] In Berlin "his emphatic testimony to the success of Stromeyer's practice and the silent evidence of his own once deformed but now nearly corrected

[1] Transactions of the American Orthopedic Association, 1894, vol. vii. p. 335.

[2] British Annals of Medicine, April, 1837; American Journal of the Medical Sciences, August, 1837, vol. xx. p. 513.

[3] Lancet, January 7, 1854, pp. 19, 20.

foot caused a revulsion of feeling in favor of subcutaneous tenotomy,"[1] a method which was not practised in England until he performed the operation in London, February 20, 1837.[2] In 1839 "he commenced the formation of the Orthopedic Institution in Bloomsbury Square, since designated the Royal Orthopedic Hospital,"[3] and the same year was published his well-known book, *Club-foot and Analogous Distortions.*

FIG. 3.

Our late honorary member, Dr. William Detmold (1808–1894), was born in Hanover, came to New York in 1837 "and introduced orthopedic surgery into this country."[4] Within two years after his

[1] Ibid, July 21, 1894, p. 168.
[2] Club-foot and Analogous Distortions, William J. Little, London, 1839, Preface, p. xi.
[3] Lancet, January 7, 1854, pp. 19, 20.
[4] Medical Record, January 5, 1895, vol. xlvii. p. 22.

arrival in New York he had made one hundred and eighty subcutaneous divisions of the tendo-Achillis in cases of club-foot.[1]

At a stated meeting held on November 21, 1878, by the New York Academy of Medicine, by whose generous courtesy our meetings are held in these convenient rooms, ex-Vice-President, Dr. Detmold, in behalf of Dr. Little, presented a copy of the bust of Stromeyer, which now occupies an honored place in Woerishoffer Hall of the Academy's library. Thanks were unanimously returned to Dr. Little and Dr. Detmold, and the former was elected a Corresponding Fellow in the following year.[2]

It is evident that in current medical opinion Stromeyer was credited with having discovered subcutaneous tenotomy, Little with having widely disseminated a knowledge of it, and Detmold with having introduced it into America. It has seemed desirable, therefore, to present these notes in the TRANSACTIONS of our Association, together with portraits of those whose work has left such an important mark on orthopedic practice.

It may be added that not a few of the advances which have been made in surgery have been due to a previous false conception of the dangers which might follow the invasion of certain cavities and regions of the body or the disturbance of certain tissues. In the case of tenotomy Dr. Stromeyer was honored because it was believed that he had discovered a safe method of dividing tendinous structures whose fibres and sheaths are now seen to accommodate themselves readily to operative traumatism. His discovery greatly stimulated the study and practice of operative orthopedic surgery. It remains to be seen when mechanical orthopedic surgery will meet with a commensurate recognition. A wider diffusion of knowledge may give to it the precedence which now belongs to operative treatment. In the matter of congenital club-foot, for instance, it is plain that tenotomy will decline in value when it is generally seen that the affection is curable by an early and patient resort to purely mechanical means.

[1] New York Quarterly Journal of Medicine and Surgery, January, 1840, vol. ii. p. 64.

[2] From the minutes of the Academy and the statements of ex-President Dr. S. S. Purple.

IRRITATION EXOSTOSIS OF THE HUMAN FOOT.

By E. H. BRADFORD, M.D.,
BOSTON.

So much attention has been paid to the rheumatic inflammation of the foot that the impression is strongly entrenched in the mind of the profession that all pain of the feet is of a rheumatic nature, and if the great toe is affected it is regarded as the gout. This impression has led to the exhibition of all forms of anti-rheumatic and anti-gout treatment in cases of this sort, so much so that it is difficult to regard any enlargement or stiffening of certain portions of the foot as anything other than of a rheumatic or rheumatoid nature.

It is, however, known that under certain circumstances of irritation, bone will become thickened very much as callosities of the skin will develop under the same condition, and the situations in the foot where this has taken place are those exposed to pressure from shoes in walking. That they do not develop in all individuals is due to various causes, partly because in some cases the feet are better protected by adipose tissue, partly because, owing to the existence of muscular strength or joint flexibility, pressure is not as constant, and partly that less pressure is exerted by some shoes than by others.

It is not to be denied that in cases of chronic rheumatoid arthritis, enlargement of the joints takes place as elsewhere, especially in the hands, and is characterized by the other symptoms of rheumatoid arthritis, and especially by the fact that there are other manifestations in other portions of the body. The parts where the enlargement from bone pressure or irritation takes place are necessarily the parts most exposed to pressure, and these are in the portions of the foot where the strain is greatest and where the bone is the least protected by fat. These are as follows: at the first and fifth metatarsal phalangeal articulation; in certain instances at the dorsal

surface articulation of the cuneiform and first metatarsal, and on the dorsal surface of the head of the first metatarsal, and on prominent

FIG. 1.

Exostosis of head of first metatarsal.

portions of the posterior part of the os calcis. The projections may be so large as to cause bursæ or callosities of the skin, which at times

may be so annoying as to necessitate excision of the exostosis or enlarged portions of the bone.

The most common of these irritative changes in bone are those seen at the head of the first metatarsal. These may or may not be

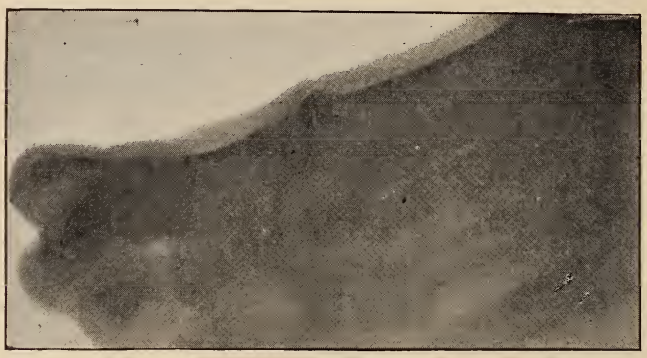
FIG. 2.

Exostosis of head of first metatarsal and hallux valgus.

accompanied by the protrusion or growing out of the metatarso-phalangeal joint. The former is more frequently the case, owing

to the prevalence of shoes which are broader or more stretchable at the ball than at the toe. Furthermore, owing to the obliquity of the articulation of the metatarsal with the first cuneiform an inward

FIG. 3.



Exostosis of proximal end of first metatarsal.

divergence of that bone is possible. Where the great toe is held at the tip and an inward motion of the metatarsal bone is possible the growing out of the joint takes place naturally. This may be accom-

FIG. 4.

Enlargement of the articulation of the first metatarsal and cuneiform.

panied by a subluxation of the first metatarsal and the exposure of the side of the head of the metatarsal to irritation, causing the thickening which is so common. Less common than this, but still not

infrequent, is an irritation and thickening on the upper portion of the head of the first metatarsus. This results from the pressure of the fold of the shoe, or of the cross welt, and may be found so great as to interfere with the play of the extensor tendons of the great toe, or cause a tendo synovitis. As, however, in a majority of cases, persons who wear shoes sufficiently tight as to cause this irritation do not, as a rule, in walking make much use of the toes and metatarso-phalangeal articulation, the pressure causes but little inconvenience.

FIG. 5.

Exostosis of the os calcis.

A similar enlargement on the head of the fifth metatarsal is occasionally seen resulting from the same cause. This is less common than that on the first metatarsal, for the reason that the tendency of the fifth metatarsal to divergence from the axis of the foot is not as common as that in the first metatarsal.

A ridge-like thickening and projection of the proximal end of the first metatarsal or of the cuneiform bone is not common, though occasionally seen. It is situated at a part of the foot where the irritation of the lacings over the dorsum of the foot would press upon the unprotected tissues, as in each step the foot glides forward and encounters the pressure of the resisting portions of the shoe, especially where high heels are worn. It is, perhaps, strange that

the thickening in this latter place is not more commonly seen, for the reason that these parts of the foot are not, as a rule, covered with fat, and the bone is exposed to the shoe irritation. This may be explained by the fact that individuals do not, as a rule, lace their shoes so tightly as to cause the irritation which is productive of trouble. That in certain instances this takes place is, perhaps, due to some anatomical variation, or any cause which throws the end of the first metatarsus into unusual prominence. This could result from a contraction of the plantar fascia.

From the skiagraph pictures here shown it would appear that this irritation produces thickening of the bone by a development of the periosteum, which afterward becomes calcified. For it will be seen that in some of the more recent cases the thickening, which is as hard on palpation as ordinary bone structures, transmits the X-ray, producing only a slight shadow, as if cartilaginous or cellular over firm bone. In the case here illustrated the projection had only existed for a comparatively short time.

The thickening around the end of the os calcis near the insertion of the tendo-Achillis has been already described in papers presented before this Association. The nature of this affection has also been carefully discussed, and its origin is due to the pressure of the seam of the shoe over an unprotected portion of bone.

The local nature of these enlargements is made clear by the fact that they frequently exist in young persons without any other evidence of rheumatism or gout and disappear when pressure is removed.

STATE CARE OF INDIGENT CRIPPLED CHILDREN.

By ARTHUR J. GILLETTE, M.D.,
ST. PAUL, MINN.

After experience with two sessions of the Legislature, I am of the opinion that the much abused politician is reasonable and humane, after all. If their attention is brought to a bill the purpose of which is the alleviation of human suffering and the benefit of the State for which they serve, they give heed and assist the cause in every way possible.

In the winter of 1897 there was introduced in the Legislature of Minnesota a bill appropriating five thousand dollars ($5000) a year for two years, for the relief of indigent, crippled children of the State of Minnesota. This, I know, will impress many of you who are connected with such large institutions as a very small amount indeed; but you must remember that in the West there existed no such institution as a hospital for crippled and deformed children, and we had no such law in the United States—or the world, for aught we know—as a precedent; further, we were given to understand that if this amount was judiciously and beneficially expended the law would become a permanent law in the State of Minnesota. So to us it was a great achievement.

It is significant, indeed, that the most eloquent advocate of this bill was a young woman suffering from a neglected and badly deformed lateral curvature of the spine. Notwithstanding this obstacle, Miss Jessie Haskins gained a college education, and naturally her pleading was doubly forcible. Significant, too, is the fact that Dr. Henry Ling Taylor, son of Dr. C. Fayette Taylor, gave to this young woman her first directions in this undertaking.

I will not weary you with the details of our experiences in trying to impress upon the legislators that this bill had but one object, that

of the care, relief, and cure of the poor, crippled children of the State of Minnesota, who, if they were not already, would finally become wards of the State; nor the surprise expressed by the members of this legislative committee when assured that these children would be cared for by physicians and surgeons free of charge; nor how proud I was of the profession when guaranteeing this, knowing full well that I could deliver the goods promised. All this was finally rewarded by a promise to introduce a bill. The question then arose, into whose hands should the institution be placed. Realizing that in order to have the bill pass it should be fostered by a body already recognized for its efficiency, we advised with members of such boards, and were either flatly refused or were met with such indifference that we felt sure would result in the failure of the institution should they accept the charge.

It was finally decided to place it in the hands of the Regents of the University of Minnesota. The only possible claim we had on them was because of the medical department of this university—the faculty of which department, it was generally understood by this legislative body—being composed of representative members of the medical profession, an assurance that the children would have the best of care. And the following bill was passed:

Chapter 289, General Laws of Minnesota for 1897.

AN ACT

To provide for the care and treatment of crippled and deformed children.

Be it enacted by the Legislature of the State of Minnesota:

SECTION 1. That the Board of Regents of the State University are hereby authorized and empowered to make provision for the care and treatment in some hospital or hospitals within ten miles of the State University for any indigent children who may have resided within the State of Minnesota not less than one year, who are crippled or deformed or are suffering from disease through which they are likely to become crippled or deformed. They shall make provision for the maintenance and care of such children on such terms as may be agreed upon between the said Board of Regents and the managers of such hospital or hospitals.

SEC. 2. The children so provided for shall receive medical and surgical treatment by the members of the staff of the Medical College of the University, and the members of the said staff shall receive no extra compensation for such medical or surgical treatment.

SEC. 3. The said Board of Regents shall adopt such rules and regulations

as they may deem proper and necessary for the admission, discharge, care, treatment, and government of such children.

SEC. 4. There is hereby appropriated out of any money in the State Treasury, not otherwise appropriated, the sum of five thousand ($5000) dollars for the fiscal year ending July 31, 1898, and the sum of five thousand ($5000) dollars for the fiscal year ending July 31, 1899, or so much thereof as may be necessary for the use of the Board of Regents in carrying out the provisions of this act.

SEC. 5. This act shall take effect and be in force from and after its passage.

Approved April 23, 1897.

Pursuant to the provision of this law, the Board of Regents undertook the care of the crippled and deformed children of the State of Minnesota.

After a careful examination of all of the hospitals of St. Paul and Minneapolis by the committee appointed by the Regents, and after receiving bids from each of them, a contract was entered into with the Board of Control of the City and County Hospital of St. Paul, by the terms of which the Board of Control agreed to set apart a ward in its hospital for the exclusive use of the children who may be received under the provisions of the law, and to provide and care for them as patients are ordinarily cared for in first-class hospitals, including nurses, attendance, food, washing, bandages, and medicine, in fact everything that the children need, except physicians' attendance and braces or mechanical appliances.

The Board of Regents pays the Board of Control for the services above mentioned, $3.75 per week for all children between two and twelve years of age, and $4.50 per week for children between twelve and sixteen years.

The rules for admission were briefly: That the child must be under sixteen years of age and amenable to treatment; that the child must have resided in the State not less than one year, and that the parents, guardian, relative, next friend, or other person shall make an affidavit stating name and age of child, etc., and also make affidavit as to financial condition. Accompanying this application must be a statement from the family physician regarding the history of the case as to the disease, present condition, and previous treatment, also his opinion as to their inability to pay for treatment.

We had a double reason for insisting upon the physician's statement: First, we wished, of course, to know the nature of the dis-

ease, and whether or not it could be benefited before taking a long journey to the hospital, and, furthermore, we did not wish to take a case away from a physician who was treating it or who felt he could treat it.

The educational feature is of great importance, as the members of this Association well know that it sometimes takes years to effect a cure; therefore next to the treatment is the necessity of educational advantages. Our first appropriation was so small that we went begging for some one to do this, and we succeeded in securing the services of Miss Antoinette Choate, who, with the assistance of a corps of young women, undertook the kindergarden instruction.

The Board of Regents, who took charge of this work very reluctantly, at the end of the first two years signified their willingness to continue the same, and I must say that the chairman of that board, Judge Stephen Mahoney, was not only willing, but enthusiastic. In short, the Board of Managers, Superintendent of the Hospital, Board of Control, teachers, house surgeons, nurses, and every one who has in any way come in contact with this work, have become interested at once, and helped it on in every way possible.

The Board of Control of the City and County Hospital, who contracted to give us only one ward, finally set aside a building for the exclusive use of these children, and to-day this building is so over-crowded that we have been obliged to place some of the children in the wards of the main building.

When the members of the Legislature of 1899 visited this hospital they were of one mind, and the Minnesota State Hospital for Crippled and Deformed Children is considered an established institution, and this legislative body unhesitatingly appropriated sixteen thousand ($16,000) dollars to continue the work until the meeting of the next legislature.

I wish to acknowledge the very important part the orthopedic institutions of the East played in this work, for it was from their statistics that we based our arguments of the practical side of the work.

DISCUSSION.

Dr. Shaffer said that he had not been aware, when asked to make an address before the International Charities Conference, that such a communication would be of special interest until assured by Mr. Rhinelander Stewart that such was the case. If he had known at the time that his friend, Dr. Gillette, had been working in the same line, it would have afforded him much pleasure to have referred to it in that address. He thought, in time, the State would come to our aid in a legitimate manner, and place at our disposal a sufficient amount of money for the care of these children. In the Industrial School for Crippled and Deformed Children in Boston, he had found that the children were taught and drilled in various methods of instruction and work. He had seen there one boy who was typewriting with his toes. The educational side of this problem was one of exceedingly great importance. When the State was appealed to for these children this side should not be forgotten. He was sure that the paper just read would have great weight in the future consideration of this subject in this State.

PIGEON-TOE, WITH THE DESCRIPTION OF AN APPARATUS TO CORRECT IT.

By W. BARTON HOPKINS, M.D.,
PHILADELPHIA.

The term pigeon-toe, though technically referring to distortion of the great toe (hallux varus), has been purposely used here to define the defect of turning the toes in, as the name thus applied, conforming to general usage, may be more widely recognized.

Pigeon-toe, depending upon some one of many causes, may exist in both feet equally, in one foot more than the other, on in one foot alone. It may be congenital and associated with equino-varus, or it may be produced as a consequence of joint disease, fracture, or paralysis. It, like out-toeing, resulting from whatever cause, may be so marked as to be removed from the class of minor defects and become a grave deformity, interfering so much with function that measures as radical as those employed for the cure of bow-leg or knock-knee may be required for its correction. In cases so exaggerated no such device as that about to be described could be hoped to be of any benefit. It is not to these I wish to refer, nor is it, on the other hand, to that condition of moderate in-toeing which is so frequently observed to coexist with competent foot-arch and slight bow-leg in sturdy, able male subjects; but to that degree of in-toeing which, either by interfering with or disfiguring the gait, becomes a defect. Belonging to the class of minor defects, it, along with others of its class, is on one account or another too frequently neglected. This, no doubt, is principally because the defect is rarely brought to the notice of the surgeon, for, like stooping and swaying the back, it is regarded by even intelligent parents as a childish trick which will be outgrown. If slight and bilateral, this it often may be. Lessons in dancing and calisthenics, if the subject is a girl, may frequently overcome it, while if a boy, it is likely to become modified to a degree which is

unobjectionable. At times, however, especially, perhaps, if only one foot is affected, the defect, unless corrected by some positive measure, remains, and if decided the individual will never have that freedom of gait which makes action a pleasure. Children with pigeon-toe incline to be inactive, and over-fat girls are frequently observed to have the defect. I believe that our efforts may well be directed toward the elaboration of measures for the cure or improvement of such minor defects, for the more that is learned of our activity in this direction the more carefully will every detail relating to the gait, during the years of growth and development, be generally observed. Several years ago, determining that the most rational method of correcting the defect was in some way to throw the foot out as it was about to be planted on the ground, I devised an apparatus, which was briefly described in the *International Medical Magazine*, July, 1892. It consisted of a swivel so constructed that the upper portion attached to the heel would turn upon the lower portion. This rotary movement was obtained by four peripherally arranged inclined planes in the upper portion, running down four pulleys in the lower portion. When the heel was planted on the ground the weight of the body caused the concentrically arranged wheels each to run down or, more properly speaking, up its appropriate inclined plane. A rotary movement of about one-third of a turn was thus imparted, which forcibly threw the foot outward when the heel touched the ground. The swivel was made to recover its first position by a steel spring. The affair answered every purpose for which it was intended, so long as it remained in repair. Finding it, however, too delicate an instrument, with its journals for the pulleys and the steel spring, to keep in good working order without any attention, I ceased recommending it, though under my own supervision it worked satisfactorily. I have recently had made the swivel shown in Fig. 1, which will be seen to possess ball bearings. The upper portion, *a*, which is inserted in the heel of the shoe, consists of a flattened cone in which have been routed out four curved radiating grooves. These form the upper bearing for four quarter-inch balls. Nicely fitted to this is a cylindrical box, *b*, the bottom of which is of an inverted cone shape, while in its centre is a post through which it is adjusted by a screw to the cone. The action of the swivel is simple enough; when the foot is lifted from the ground

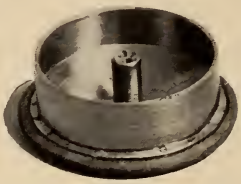
the balls drop to the centre of the box. Instantly the weight is put upon the cone, the balls are forced to the periphery of the box, because the inclination of the grooves in the cone is much greater than the inclination of the bottom of the cylindrical box. In seeking the periphery, therefore, though rising to a higher level, they are really rolling down an inclined plane. About one-half a turn is thus given

FIG. 1.

a

Showing cone-shaped portion (inverted).

b



Showing cylindrical box.

the cone and imparted by it to the foot. The swivel may be made in various sizes adaptable to shoes for children of from three to fourteen years of age. The former are five-eighths of an inch high, or about one-eighth of an inch higher than the usual swell given to the sole at the back, in the heelless shoe of a young child.

FIG. 2.

Shoe with swivel attached.

One of these swivels which has been in use for the past two months appears to improve rather than to deteriorate by use; it has needed no attention, and its action is definite and decided. It causes no inconvenience to the child, and mounted as shown in Fig. 2, its presence is not unsightly; indeed, it is hardly noticed. It cannot be used in mud or sand, though, as it is made of phospho-bronze, it is not affected by moisture. While originally intended for the correc-

tion of in-toeing, it will be at once apparent that the device is equally applicable to correct out-toeing in certain cases. It is, therefore, unnecessary to mention that the swivel here shown, made to correct pigeon-toe of the left foot, would be the one appropriate for out-toeing of the right foot. The only other apparatus I have seen for the correction of pigeon-toe was a double brace extending on both limbs from the ankles to the hips, where two arms were connected by an elastic band at the back—an affair too elaborate and cumbersome to be commonly used.

The swivel is applied to shoes by Messrs. Benkert & Co., 1104 Chestnut Street, Philadelphia.

DISCUSSION.

Dr. Hubbard, of New York, said that the cases of pigeon-toe that had come to him had been young children who did not wear heels on their shoes. He had used in such cases a band attached diagonally, passing over the thigh, around the hip, and attached to a waistband on the opposite side.

Dr. Royal Whitman, of New York, said that he believed nine-tenths of all cases of pigeon-toe were merely symptomatic of weak foot or of slight knock-knee. In the remainder of these cases the pigeon-toe was the result of slight varus and twists in the bones from bow-legs or coxa vara. The majority of such cases being symptomatic, they should be treated not by such an appliance as that just exhibited, but by treating the underlying condition.

Dr. Ridlon remarked that all the cases of any importance that he had seen had been associated with equino-varus.

Dr. Foster, of Cambridge, had observed, he said, that these cases could be best cured by military drill. After a boy had been subjected to the criticism of a whole battalion he soon learned to walk properly.

Dr. Hubbard said that in the cases that he had seen there had not been the slightest equino-varus or deformity of the bones; there had been simply an inability to rotate the foot outward.

Dr. McKenzie said that if a person toed-in there must be a reason for it. If an appliance were used on the outer side of the leg to cause external rotation it would strengthen the internal rotators, and consequently the patient would be made worse by this arrangement. He would not agree with Dr. Whitman in saying that pigeon-toe was an indication of weakness only. He recalled a case of ordinary congenital club-foot in which, although *the foot* had been fully corrected by operation, yet the child had toed-in. This had been due to a twisting of the bones, and was corrected by osteotomy of the tibia.

Dr. Wilson said, with reference to the rotation of the entire leg with an apparatus of this kind, that when this apparatus had been first exhibited in Philadelphia it had been demonstrated that the rotation was purely an ankle-joint rotation. In some cases he had found an appliance of this kind desirable, and it seemed to him to act directly on the parts involved.

Dr. Foster said that our habit of walking with the toes outward was due to the wearing of high heels and walking on stone pavements. Primitive races habitually walked with the toes straight.

Dr. Hopkins, in closing, said that the apparatus could be made small enough for use in a child of three years, if required. He had already stated that in many cases no such appliance was required, as dancing or gymnastics would accomplish all that was needed. He could not accept the statement that pigeon-toe was due to weakness; it was seldom associated with flat-foot. It was only in cases in which one toe principally toed-in that he recommended his apparatus. In cases of severe in-toeing, such as followed fractures, its use would be necessarily restricted.

A TREATMENT FOR ACUTE SEROUS SYNOVITIS, PERMITTING JOINT FUNCTIONS.

By PHIL. HOFFMANN, M.D.,
ST. LOUIS.

In October, 1895,[1] and in February, 1896,[2] the writer reported a simple method of treatment for acute serous synovitis of the knee and other joints, which method at that time he had exclusively and successfully employed for about a year. Since these two publications he has had no reason whatever to renounce the treatment; but, on the contrary, as he became more experienced and adept in its application, has had greater cause to continue its use. The method might be called the *compression treatment.* In his hands it has proven far more satisfactory than the old ones of rest and immobilization, hot and cold applications, evaporating lotions, etc. Its application is quite simple, though considerable care and judgment should be exercised. The principle is to fill all depressions about the joint with cotton, and then to apply strips of rubber adhesive plaster in such a way as to entirely encircle the joint and several inches of the limb above and below it, so as to make firm and equable compression. The joint in which it has been found to be of the greatest value, and in which the results both immediate and permanent are truly remarkable, is the knee. This, moreover, is the joint by far most commonly affected by acute serous synovitis, whether produced by injury, exposure to wet or cold, over-exertion, or some indefinite cause.

As an illustration I will detail one of the many cases treated by this method in the past four years: A carpenter, aged thirty-seven years, struck his left knee, not severely, against a work-bench. He felt slight pain at the time, though it did not inconvenience him

[1] American Medico-Surgical Bulletin, October 1, 1895.
[2] St. Louis Medical and Surgical Journal, February, 1896.

enough to make him quit work, at which he continued until the close of the day. The next morning his knee felt somewhat stiff and sore, and he observed that it was slightly swollen. He, however, could get about, and attended to his work as usual. During the day the swelling increased and the joint became very painful, and compelled him toward the middle of the afternoon to keep off of his limb entirely. When I saw him the next day, forty-eight hours after the accident, the left knee was two and one-quarter inches larger in circumference than the right; the joint was filled with fluid, as evidenced by fluctuation and "riding" patella; the skin was hot; there was great pain, the slightest attempt at movement caused intense suffering; and the parts were exquisitely sensitive to touch. The leg was flexed at an angle of about 135° to the thigh.

Treatment. A pad of cotton was placed in the popliteal space, and the parts were covered with a close-fitting stocking-leg. Over this stocking protection the adhesive plaster was applied as follows: A strip about one inch wide and thirty inches long was made to encircle the leg about six inches below the patella and carried upward until the somewhat conical shape of the calf caused it to materially alter its course. Another strip was then applied, overlapping the first. Above this another, and another, and so on, ascending the leg, over the patella and up the thigh to about six inches above the upper margin of the patella. Each strip of plaster was drawn very tight, so that the joint and several inches of both the thigh and leg were encased in a firm adhesive-plaster support, which exerted considerable pressure on all sides. A muslin bandage was applied over all to firmly press the layers of plaster together.

The patient winced considerably during the application of the dressing, but after the same was once firmly applied the change was almost magical. The pain was entirely relieved, and a sense of security was imparted to the joint. After some hesitation he was induced to use the limb and, to his surprise, he could walk without pain and with only such lameness as was caused by the flexed position of the limb and the restriction of the bandage.

Twenty-four hours later, as the dressing was quite loose, on account of the swelling having considerably subsided, it was removed. Measurement showed that the swelling was only one inch, a decrease of

one and one-quarter inches. It was also found that the knee could be fully extended. As the dressing became loose slight pain reappeared in the knee. A new dressing was applied to fit the changed contour and extended position of the knee, and the patient felt well enough to again take up his work, at which he continued throughout the whole course of treatment. Two days later, the swelling having gone down to one-half inch, a new dressing was applied. Other dressings were applied on the tenth and sixteenth days, and the patient was discharged, cured, twenty-two days after the accident, though he was practically well so far as the usefulness and painlessness of the limb were concerned one day after the first dressing was applied.

I have treated altogether by the adhesive plaster method 156 cases of synovitis, most of them at the orthopedic clinic of the Missouri Medical College. The one cited above is not exceptional; the result in the majority was equally gratifying. I have, in fact, almost entirely discarded the older methods in favor of this.

In place of the stocking under-dressing, one of glazed sheet cotton (cotton batting) may be used. Often I place the plaster in direct contact with the skin, especially when the swelling is slight or after it has considerably subsided. This makes a somewhat more efficient dressing, as a better hold and firmer compression can be secured. However, when applied this way, the skin after awhile frequently becomes sore and compels one to resort later to a protective under-dressing.

The adhesive plaster should be applied very tightly. In the knee and ankle there is little danger of swelling from venous constriction below the dressing. In the rare instances where this does occur the constriction will be found at the lower edge of the dressing; a few nicks here and there will remedy the fault. At the elbow, on account of the many superficial veins of the upper limb, swelling is of frequent occurrence, and it is often found necessary to support the forearm, and even the hand, with a muslin or flannel bandage to the point where the plaster compression begins.

One of the most remarkable results of this treatment is the rapid absorption of effusion. In a joint swollen two inches the swelling frequently in the course of twelve or twenty-four hours diminishes to one inch or even less. Thus a change of dressing is nearly always

necessary at the end of the first twenty-four hours. Subsequent absorption is less rapid.

Whenever flexion was present the dressing was applied to the joint in the position in which it was found, and from day to day, as the dressing was renewed, the limb became much straighter. In this way forty or fifty degrees of flexion were often reduced within two or three days.

When there is no objection to the additional expense, or when the dressing is intended to remain on a long time, it is well to make the support stronger by applying another layer or two of plaster.

The chief advantages of this dressing are its small weight, the immediate relief from pain that it affords, and, most important, that it permits the joint functions—motion and weight-bearing—without injury. A number of my patients have been doing hard labor a day or two after the dressing was adjusted to an acutely inflamed knee-joint. The time required for complete recovery is anywhere from a few days to two or three weeks. I certainly would not recommend active exercise when perfect rest can *as conveniently* be secured. I have, however, observed no practical benefit from non-use of the limb in the cases where it was enjoined. Those in which exercise was permitted did apparently just as well. Most of the patients treated at the college clinic were day-laborers who desired treatment there on account of poverty. To them enforced idleness would have meant neglect of home and family. As a rule, I permit my patients *to use the limb in any way that does not cause pain or discomfort.* On four occasions, after aspirating the knee-joint, I have applied the adhesive-plaster dressing and allowed the patient to walk without experiencing any subsequent ill effects.

The results of treatment may be accounted for as follows: When the joint is filled with fluid there is distention of its capsule, a stretching or tendency to pull asunder its ligaments. This pull upon or straining of these soft structures causes the pain. The plaster, firmly bearing on all sides of the joint, supports the overstretched ligaments, and, by compacting all the tissues and fluid within its grasp, reduces the lumen of the engorged bloodvessels, thus relieving congestion. Perhaps the joint-fluid, which cannot be compressed, by being squeezed on all sides is hurried into circulation. This would account for the rapid disappearance of effusion.

This treatment for acute serous synovitis suggested itself to me after a two years' successful trial of the now well-known adhesive-plaster treatment for sprain of the ankle. The treatment for ankle sprain was first introduced to the American profession in 1893, by our fellow member, Dr. V. P. Gibney,[1] who credited Mr. Edward Cottrell, of London, as having originated the treatment in 1885. However, this method of treating sprained ankles was used over forty years ago by one Peter Hood, who described it in a pamphlet published in 1858 by Messrs. Churchill, London. His son, Wharton P. Hood, also referred to the treatment in a book *On Bone-setting*, published by Macmillan & Co. in 1871. I also find mention of it in the *System of Surgery*, by Gross, published in 1872, and in *A Manual of Surgery*, by W. Fairlie Clarke, American edition, Wm. Wood & Co., 1880.

We are indebted to the *sprain treatment* for the suggestion of adhesive plaster as a *joint support;* but it had not been employed in the treatment of *acute serous synovitis* previous to my publications, to which reference has already been made.

[1] New York Polyclinic, January, 1893.

SURGICAL INTERVENTION IN CASES OF SPASTIC PARALYSIS.

By B. E. McKENZIE, M.D.,
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It has been a matter of surprise to the writer to learn how many of the cases that come to the orthopedic surgeon for treatment are disabled as a consequence of some affection of the central nervous system. Of these none are commonly regarded as more hopeless than the cases of spastic paralysis. Even of this special affection many varieties present themselves. No one element, however, which enters into these cases has so much influence in determining the prognosis as to the result of orthopedic treatment as the condition of the intellect in the individual case. In my observation more than 60 per cent. of all cases seen were deficient mentally. The importance and frequency of these cases have not been duly recognized until within the last few years; but it is now well understood that in the early years of life cerebral palsies are nearly as common as the spinal variety. From the etiological stand-point they have been divided into three groups.

1. Those due to prenatal conditions.
2. Those following birth accidents.
3. Those depending upon disease or trauma after birth.

The upper motor neuron is well formed only at the ninth month of intra-uterine life, and is not completely developed until the second or third month after birth. Much defect in this part is always marked by spasticity and impaired motility in the muscles supplied by the lower and terminal motor neuron. The pyramidal tracts in the cord are a direct continuation of those tracts in the brain, each being connected chiefly with the motor tract in the opposite half of the brain. Disease in these tracts implies paralysis, but

as disease of these tracts in the cord is generally secondary, the paralysis is not so much the result of the lesion in the lateral columns as it is of the lesion higher up, which has given rise to degeneration in the columns of the cord. Paralysis, with disease of the lateral columns, is associated with two symptoms which are due directly to the diseased fibres in the spinal cord. The first of these is the spastic contracture of the paralyzed parts. The second is the increase of the deep reflexes when there is a lesion in the lateral columns of the cord or in any higher part of the pyramidal tract. Rigidity, contracture, and increase of deep reflexes are the constant accompaniment of these cerebral palsies of childhood. Convulsions are much more common than in cerebral palsies of the adult; the lesion is generally cortical, while in the adult it is more commonly intracerebral; hence they are more commonly followed by epilepsy than in the adult. This proves a serious complication, as it generally brings about further degeneration and increased mental defect. If the character of the palsy is such that the lesion in the child can be proved to be capsular rather than cortical the prognosis as regards epilepsy may be considered favorable.

Monoplegia is exceedingly rare. The form most commonly found is diplegia, affecting chiefly the lower extremities. These cases of diplegia are due nearly always to prenatal lesions or to traumatism during labor. The most common cause of the trouble is found in meningeal hemorrhage which occurs during protracted labor, and hence more frequent in primiparæ. As the hemorrhage in such cases is generally at the vertex, both hemispheres of the brain are involved, and as the centres controlling the lower extremities are situated in the upper part of the Rolandic area, and as the pyramidal tracts become involved the resulting injury produces spastic paraplegia in these cases. When the effects of the hemorrhage are confined to the surface of the brain, rigidity largely predominates over paralysis. The depth of cerebral injury in cases of traumatic origin is the chief factor in determining the form of hemiplegia or diplegia. The deeper the destruction the more profound is the paralysis. Palsies always follow the involvement of the motor cortex or its pyramidal tracts, but if the frontal lobes are affected idiocy is a consequence and is a frequent accompaniment of motor disturbance. In about one-fourth of these cerebral birth hemorrhages the spinal cord

is similarly affected. The great majority of natal and prenatal cases present a bilateral palsy. After birth the tendency is to one-sided paralysis, and after the age of three it is almost the invariable form.

Though the etiology, pathology, and symptoms of the early stages of this affection are matters of deep interest, yet these cases almost invariably present themselves to the orthopedic surgeon at a time when he can exert no influence upon them except through operative interference or by methods of training and development.

Very commonly the early months of infancy have passed without anything unusual having been noticed in the history of the child's development. Even in cases where there seems to have been a backwardness observed, both the parents and the professional attendant are inclined to ascribe the condition to weakness and to suppose that as soon as the general condition of the child shall be brought up to par that it will show a normal ability mentally and in the matter of locomotion.

Several months pass, in some instances, before a condition of rigidity of the muscles is observed; in other cases this condition is noticed at birth. Smallness of the head, deficiency of the frontal portion, inability to sit alone after six or nine months, lack of the usual infantile efforts to talk, are some of the most easily observed early signs of this affection.

From the first the nutrition of the paralytic muscles and the tendency to contractures must be met by massage, passive movements, faradism, and so forth. As soon as contractures appear mechanical appliances may be used to some advantage if the intellectual development of the patient is such as to enable him to put forth a personal effort.

Until the time has arrived when the child can sit erect and show some disposition to balance the trunk upon the lower extremities, little or nothing can be done through surgical treatment. In very many cases, however, the general development and strength of the child are sufficient to enable a decided effort to be made in furtherance of locomotion, but the spastic condition of muscles, especially of the adductors, the hamstrings, and those controlling the feet, and the consequent deformity place an insuperable impediment in the way of successful walking. Of the cases which the writer has seen, the

age has varied from infancy up to twenty-eight years. When the patient has acquired sufficient age and development to have strength enough to walk, but is prevented from doing so by the contractures and the obstruction caused by deformity resulting from contracture of the affected muscles, free tenotomies and myotomies have been made so as to place the deformed part in a correct position and to relieve restricted movement as much as possible. The muscles which demand attention more frequently and which have been most thoroughly incised are the adductors. It has been my practice, after cutting these at their origin at the pelvis, to abduct the limbs at once to such a position as to place them at an angle of from sixty to ninety degrees with each other, and then to retain them in this position for several weeks. While there never has been a resulting defect in muscular power which has been harmful to the patient, yet there has been in no case a return to a condition of spasm. I can commend this practice most unreservedly. Free cutting of the hamstrings may be done with a similar result; in like manner any number of tenotomies and faciotomies in the feet may be performed to rectify any deformity which may be found present.

Not only is the contracture removed, but also there is a great lessening of reflex action which is of exceeding benefit thereafter. This is a result which I am unable to explain; but of the existence of the fact there can be no doubt.

Case I.—M. M., aged twenty-seven years, female, bright mentally, but never able to walk. The case was a natal or prenatal diplegia involving the lower extremities and her right arm. The exaggerated and uncontrollable spasm which would occur in this case when any voluntary effort was made was a source of much annoyance. After making numerous tenotomies in this case, the feet and limbs have been brought to a comparatively normal position, so that she has, with the aid of appliances, acquired the power to walk when she takes her brother's arm. This, however, is not the improvement which she prizes most. She experiences the greatest comfort from the lessened reflex action in all three extremities.

By intervention of this kind cases that would otherwise never have any prospect of walking may be so much helped as to walk very well without the aid of any appliance.

Case. II.—I. W., aged four years, a fairly well nourished child, bright intellectually, has never learned to walk, has very strong contraction of the adductors; extension at the knees to an angle of one hundred and forty-five degrees and marked valgus of both feet. Adductors were freely cut at their origin at the pelvis, and the legs kept separated so as to form an angle of ninety degrees with each other for a period of three weeks. The hamstring tendons were cut, the legs extended nearly to a straight position. The feet were forced into a position of varus, and the limbs and feet thus retained for three weeks.

After removal of the fixed dressings appliances were employed extending from a pelvic band to the boots, jointed at the ankles and knees, the latter joints being capable of self-locking. An apprenticeship in walking was spent during the few months while these appliances were worn. The child was able to walk from one room to another in three months, and now, eighteen months after operation, the limbs are straight. No appliances are worn in the daytime and the child walks well. At night simply braces are worn, which keep the knees fully extended and the feet at right angles. Flat-foot boots are worn.

Our experience in this and other cases goes to show that very often appliances need not be worn during the day.

Massage after operation should be continued for months or years, and has a marked influence for good in improving the tone and suppleness of the muscles.

Training in the regular class in corrective gymnastics is a powerful means of helping these patients. In any affection requiring the corrective gymnastic treatment the results obtained will depend largely upon the personal intelligent effort put forth by the patient. So in these cases it is only those who have at least a moderate amount of intelligence who get much help. The same is true, but to a less extent, in the wearing of appliances. Idiots and imbeciles of the lower grade will not make the personal effort which is essential to success.

In reference to this work of training, it is worthy of remark that it is one of the most important agencies employed by those who devote their attention to the intellectual development of nervous and backward children. Similarly, it may be pointed out that surgical

operations which improve the physical condition of these unfortunates, which inspire confidence and hope, which take them out-of-doors, which make them independent of others in moving about, which bring them into contact with nature, become a powerful agency in lifting them to the status of intelligent citizenship.

DISCUSSION.

Dr. Ketch said that he had read a paper before the Orthopedic Section of the New York Academy of Medicine about two years ago on the treatment of spastic paralysis. In that paper he had practically arrived at about the same conclusions as had just been presented. Clinically he divided these cases into three classes, viz.: 1. Those in which there was absolutely no mentality; 2, those in which the mentality was impaired, and 3, those in which it was normal. On the mental condition he had based the prognosis, and to a certain extent the treatment. Stimulated by the reports of Rurecht, of Dresden, who had made the statement that after tenotomy in some of these cases both the local and mental condition had been improved, he had tried tenotomy in quite a number of cases at the Institution for Idiots on Randall's Island. He had been interested not only in the question of improved mentality, but also in the permanency of reposition after tenotomy for spastic paralysis. As the condition was one of constant irritation emanating from the brain or cord, it did not seem logical to hope for any material interference by tenotomy with this transmission of impulses from the brain or cord. He believed, with Dr. McKenzie, that if these children could be subjected to proper educational training, and could be brought in contact with other children their gait and mentality would improve, but until the time had arrived when the contracture of the tendon had become more or less permanent, and the irritation, for reasons not yet understood, had begun to lessen, it was not proper to resort to tenotomy. Where this operation had been done in young children exhibiting intense spasm the results had not been as good as in older children. The incubus of mechanical apparatus was so great in these defective children as to be harmful rather than beneficial in many cases.

Dr. Ridlon said that he had operated upon every one of these cases that had come to him for some years past, and he did not feel that the last speaker was entirely right in his impression that all of the cases were apt to relapse to a disagreeable extent if operated upon when young. Personally, he believed that all these children should be operated upon when young, because the irritation would be relieved, and the mental condition was often benefited. If there were a certain amount of relapse the operation should be repeated, if necessary, more than once. This was better than leaving them without such interference for a long time. The part most contractured should be cut first, and that was usually the tendo-Achillis. One should wait for two months before cutting the other structures, as, for example, the hamstrings. When the surgeon waited this length of time it was often unnecessary to cut them at all. The adductors and the fascia of the hip might next need attention, but they should not be cut for another interval of two months. He referred to a little girl from Kansas City who had hip and knee contractures. The cutting of the tendo-Achillis gave complete relief in the left limb, but only partial relief in the right one. After two months the hamstrings of the left knee had become so completely relaxed that no other operation was required on that side, although it was demanded on the other side. No operation on the hip muscles had been required. He had not derived much satisfaction from the the use of braces in these cases. If plaster was kept on for from four six weeks braces would not be required afterward—a fact which had surprised him—but he had learned it by experience. As to the improvement of the spastic condition, he would say that he had had but one case which had not been materially improved, and the only difference between this and the others was that this boy was set into a general tremor by slight excitement.

Dr. McKenzie asked if he was to understand that, in the case referred to, the arm had been so relieved by the first operations as not to require operation.

Dr. Ridlon replied that when the tendo-Achillis had been cut it had not been found necessary to operate upon the other parts. He could offer no explanation for the improvement in the arm, but it was nevertheless a clinical fact.

Dr. Ketch said that he had depended largely upon training in the early years. He used apparatus to keep the parts approximately in the normal condition. The use of apparatus in many of these children he considered an actual detriment.

Dr. Sherman said that he had formerly been in the habit of cutting tendons in these cases without reference to any special time, and as he had not secured good results he had abandoned this practice After a time he had again begun cutting tendons because of some advice received from Dr. Sayre. He now not only cut the adductor tendons, but separated the legs widely—one hundred and eighty degrees, if possible. He cut the hamstring tendons and tried to stretch the posterior ligament of the knee-joint, and the same thing was done to the tendo-Achillis, the foot being put up in dorsal flexion. Even then relapse sometimes occurred within a few weeks. When this happened he repeated the cutting. Some of these cases after the secondary cutting had done exceedingly well, while others had been relieved of their contraction, but had been left with a great deal of muscular weakness. This had led him to consider in these cases not only the muscular spasm but the probable usefulness of the muscles after cutting. He could not understand why apparatus should be put on at night, as these children slept like normal children, with general muscular relaxation. In one instance he had cut the tendons of a child who was an idiot, without appreciating the mental condition, and he thought it would be wise to make a note of each case's mentality.

Dr. Judson said that he had had a limited experience with these discouraging cases, but would agree with Dr. McKenzie that education was an important element in the treatment. In addition to this he had been accustomed to make use of mechanical treatment in cases in which the locomotion had been interfered with by talipes equino-varus. He recalled two instances of this kind in which the mechanical treatment had been satisfactory. In one the lines of treatment had been similar to those followed in talipes equino-varus of the paralytic or congenital variety. In one the treatment had been so successful that the apparatus had been laid aside, and the child had walked very satisfactorily. The apparatus had had to be continued in the other case.

Dr. Shaffer said that the very condition mentioned by Dr. Sherman was to him a contraindication to any operation. At the time Dr. Ketch had read his paper he had brought up this question and had asked for information from the neurologists present. In some of these children one would find a gradual relaxation of the tissues under dorsal flexion. At one time he had strongly advised operative interference in all these cases, and had done it, but with unsatisfactory results, as calcaneus had often followed. If these cases were carefully watched there would be found a time in which the spasticity entirely disappeared and the contraction became permanent. In almost every case in which he had not begun treatment until this stage had been reached the results had been excellent, and he had accordingly laid this down as a dictum for his guidance in the treatment. He objected very much now to operating upon a case in which the spasticity of the muscle was so pronounced as to disappear under an anæsthetic.

Dr. Bradford stated that the late Dr. C. F. Taylor had informed him that he had found mechanical treatment unsatisfactory in this class of cases. Dr. Bradford said that it was his practice to tenotomize in these cases; but in two instances mechanical treatment had been carried out for a number of years, with improvement of the patient.

Dr. Weigel said that several years ago he had presented a communication on this subject, together with photographs of two severe cases upon which he had operated at that time. The results in those cases still remained good. In the first the child had been tied down in a most awkward position, so that the hamstring and other tendons had required very thorough division by open incision. In the second case there had been some doubt as to the propriety of operating because of the low mental state of the child, but improvement in the mental condition had been one of the most startling features of the case. The patient was fourteen years of age, and the operation had consisted in extensive tenotomy and myotomy through an open incision. The improvement in the mental condition had been very prompt, and had been very noticeable before the patient left the hospital. The relief of the constant tension must have an important influence on the physical development.

Dr. McKenzie closed the discussion. He said that so far from having had relapses and finding results unsatisfactory, his experience in these cases had been more satisfactory than in almost any other field of orthopedic surgery. He had had some disappointments, but they had been for the most part before he had appreciated the necessity of distinguishing sharply the mental state. In one girl everything had appeared exceedingly hopeful with the one exception that she had not had sufficient "sand" to make the necessary effort to co-operate with the surgeon in carrying out the treatment.

He had not met with any sudden and marked mental improvement such as noted by Dr. Weigel. It was rational to expect a gradual and reasonable mental development from intercourse with others and from the improved surroundings.

It was true, as Dr. Ketch had said, that there was a constant irritation; the involvement of the pyramidal tracts determined the element of spasticity. In every single instance in which the tendons had been cut the deep reflex action had been greatly lessened. The time for the operation was not to be determined by the spasticity. A few weeks ago he had seen a boy who, although having fair intellect, had such dangling legs that it had seemed inadvisable to operate until a little further education had improved his condition. He had not found the tendo-Achillis the one chiefly at fault; the adductors were the great sinners. The time for doing the tenotomy must be determined in each case by a broad consideration of all the features. He used appliances at night in these cases for the same reason that he employed them in club-foot cases—*i. e.*, because he had found that if this precaution were not taken relapse was likely to occur. He had operated upon a young woman, twenty-seven years of age, who could neither stand nor walk—even the muscles of the head and neck were in a spasmodic state. She was a bright, intelligent woman. The adductors and hamstrings and many of the tendons of the feet, the flexors of the thigh, certain tendons in the arms had all been successively tenotomized, and she had been materially improved. In addition she had practised self-suspension. The chief advantage of the treatment, from the patient's point of view, was the control of the deep reflexes. His experience had been such as to lead him to think that Dr. Judson's case would have been markedly improved by cutting the tendons.

THE RECORDING OF LATERAL CURVATURE OF THE SPINE.

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It is necessary in considering this subject to recognize that lateral curvature of the spine presents a variety of aspects under different circumstances.

There is always a worse position and a best position, and there is a best position which the patient can assume, and a best position which the surgeon can produce by manipulation. There is one position in standing, another in sitting with the back exerted, and another in sitting with the back relaxed. The question arises whether we are to record the position of the spine in all these various postures, or whether we are to take one particular position alone.

Personally, in cases which do not present any special peculiarities, I have made records of the habitual position adopted by the patient *while sitting without the back being supported.* My reason for selecting this posture is that I believe the curvature increases chiefly or entirely at the time when the patient is sitting under such circumstances—*i. e.*, with the back relaxed. When a patient sits down with the back exposed for the surgeon to make his examination he often adopts a far better position than is customary with him, and it requires some few moments at least, and the distraction of his thoughts, to induce that patient to assume his habitual position. The surgeon should then endeavor to straighten the spine with his hands and to press it in various directions, and then again to leave the patient to assume his own position. After a brief period we are enabled to form an opinion as to what the habitual posture correctly is.

The patient must then be directed to stand up, and the probability is that the curves will be lessened. They may, however, be increased,

or so much altered that a record in that position is also desirable. In the standing position the patient should be directed to place the heels together with the knees quite straight, and then the surgeon, placing his hands one on each crest of the ilium, is able to detect any shortness of one or other of the lower extremities. We may judge by the eye alone as to the comparative heights of the hands, or we may adopt the very convenient plan of comparing the level of our hands with any horizontal line in the room, for which purpose a dado is generally useful. If one leg is short we may, by placing a book or block underneath it, observe the alteration produced in the curves by so doing. In some instances this readjustment of the length of the limbs will entirely or greatly remove the appearance of the curvature, and it becomes a question for the surgeon to determine as to whether it is desirable to accurately record these differences by any special method of measurement.

In such instances this shortness of a limb may, of course, depend upon various conditions, either structural shortness of the limb itself, or flat-foot, contractions of the joints or other conditions, all of which have to be taken into consideration. This want of symmetry of the two sides may, though rarely, involve the pelvis, so that it has an effect when the patient is sitting as well as when standing. In such instances the placing of a block or book under the buttock of the short side will have the effect of reducing the lumbar curve.

There is one other position which denotes, as a rule, the extreme extent of the rotation. It is the stooping posture; but I will here remark that as extreme stooping produces any *exaggerated* increase in the deformity of rotation, it is not an indication of the habitual degree of that item of the deformity, and that the exact record of this exaggeration is not of so much value as is sometimes stated, whereas a record of the degree of rotation in the habitual sitting posture is of the utmost importance.

The variety of these various postures and their influences upon the spine would require a treatise on the subject of lateral curvature for their entire elucidation, and it must be left for the orthopedic surgeon himself to determine as to which and to how many of these positions it may be desirable to record accurately.

Having determined what position we would wish recorded, we have the following methods to help us:

1. Photography.
2. Radiographic photography.
3. General measurement by tape and rule.
4. Measurements by means of mechanical apparatus.

Photography. This method is of the utmost value, and is a certain record as far as it goes. The ease with which it can be applied enables the surgeon to record as many various positions as he may think desirable with the least expenditure of time and trouble. It

FIG. 1.

Represents a patient with severe rotation placed in a diagonal attitude.

is often difficult to so arrange the light that the exact curves will be shown, and it enhances the value of the photograph if we previously mark out the line of the spinous processes with a flesh pencil. To be very precise, we may take a photograph first without, and then with, this marking. If thought desirable, other markings may be made, such as outlines of the scapulæ.

It is difficult to record the degree of rotation by photography, but this can be done by varying the position of the patient.

If the photographs are taken upon the same scale each time we

can compare one with another by measurement. Figs. 6 and 7 indicate this plan of making records, Fig. 6 being before treatment was commenced, Fig. 7 after a certain period of treatment.

FIG. 2.

Shows her in a profile position.

FIG. 3.

Represents a photograph taken from above downward, which shows the amount of rotation fairly well.

FIG. 4. FIG. 5.

Figs. 4 and 5 show the same patient after a certain period of treatment.

Radiographic Photography. This is very useful in those patients whose vertebræ can be represented by this means, and I have found that in patients who are not very stout this can be done irrespective of age as far, at least, as the lumbar region is concerned. By this method we are able to see to what extent the curvature depends upon alteration in shape of the vertebræ and to what extent upon laxity of ligaments.

General Measurements by Tape. I have found the following very useful measurements: 1. A vertical measurement taken from the seventh cervical vertebra to the fold of the buttocks. 2. Measurement from the spinous processes between the shoulders, round each shoulder back to the previous point. 3. The height of one shoulder above the other. 4. The difference in level of the inferior angles of the scapulæ. By means of a flesh pencil we may mark the back where the vertical line touches the body and measure between this vertical line to the apices of various curves; also from this line

we may make a horizontal measurement to the angles of the scapula, and from this vertical line to each side of the body and in other directions, and measure the variations.

Mechanical Measurements. A variety of complicated apparatus have been used for recording lateral curvature of the spine. These machines are more or less useful for the purpose, but I will describe a comparatively simple mechanism which seems to me to answer the purpose perfectly. It is adapted especially to measuring a patient when sitting down.

FIG. 6. FIG. 7.

A horizontal line drawn at the level of the shoulders in Fig. 7 is considerably above the level in Fig. 6, showing the increase in height. A line is drawn vertically from the centre of the neck to the fold in the buttocks, and we then measure between this upright line and the spinous processes where the curves are greatest. Other measurements may be made in the same way.

It consists of a simple frame made of metal or wood, each part being graduated like a measuring rod. It may be about thirteen or fourteen inches in the transverse and about twenty-three inches in the vertical measurement. This frame, being placed agoinst the back of the patient, resting on the same seat, and being placed parallel with the transverse diameter of the pelvis, may be used in various ways. The patient can be photographed in this position and, if desired, lines

of thin string or thread can be fixed transversely and vertically, so as to cut up the spaces into smaller ones. I am not in the habit of adopting this latter method, as I find that by measurement from various points of the frame to the back all the essential features of the curves may be noted. A straight measuring-rule may be used for this purpose. We can record the position of the inferior angles of the scapulæ, the distance of the curves from the central vertical line and, in fact, all other important points, the details of which need not be described to those who have experience of this deformity. I have devised a variety of additions to this frame, but I think that the rule and tape are quite sufficient for any amount of record.

FIG. 8.

Represents the framework *in situ*.

As to the measurement of rotation, we may place a stiff rod across the frame at any point and, with an ordinary measuring-rule, note the distance of the back from the plane of the apparatus.

An important point in measuring rotation is to note the angle at which the transverse surface over the spinal column lies in comparison with the transverse diameter of the pelvis. It is not, as a rule,

difficult to estimate this angle, and it is the keynote to the exact degree of rotation, except in those rhachitic cases where there is so much deformity of the bones that the spinous processes do not indicate the exact position of the bodies of the vertebræ.

To explain this point in other words: We have to note the position of the rotated spinous processes, and of the transverse processes on the side of the convexity of the curve; and these points will show us the degree of rotation.

A STUDY OF A CHILD PRESENTING MULTIPLE DEFORMITIES, WITH PRESENTATION OF SPECIMENS.

By GEORGE R. ELLIOTT, M.D.,
NEW YORK.

A Preliminary Neurological Communication by Drs. Joseph Fränkel and B. Onuf (Onufrowicz).

The object of the present communication is a study of clinical and post-mortem findings of a child aged seven years presenting multiple deformities of the extremities. These deformities were double drop-wrist, double drop-foot, subluxation of the hip-joint, and a forward dislocation of the right radius. At the age of four years, in September, 1895, Ida S., was admitted to the wards of the Montefiore Home for Chronic Invalids. Family history negative. One child died after an attack of measles. Patient born at full term; no artificial aid; said to have had convulsions at times of an indefinite nature. Child did not move her hands immediately after birth; never walked nor talked.

Status: Weight, 29½ pounds; length, 84½ cm.; well nourished. Right and left wrist-drop; right and left foot-drop; contractures of upper extremity. Feet in double talipes equinus, right foot showing some varus. Upper extremity flabby; motility of shoulder-joints normal; motility of right elbow-joint limited to passive movements —cannot be flexed beyond a right angle. Excursion of right forearm, ninety degrees; left, one hundred and fifty degrees. When forearms are raised and hands left to gravity both assume the characteristic drop-wrist position; can extend fingers. When asked to grasp an object she takes it between the index and middle fingers, seems unable to raise the thumb. This applies chiefly to right hand, which she constantly favors.

Lower Extremity: In addition to the double drop-foot alluded to there is considerable shortening of left leg; there is a depression in left buttock. When child is held and attempts to walk two things are apparent—a prominent lumbar lordosis, and raising the thigh without corresponding movements in leg and foot. Sensibility normal.

Head: Motility normal, circumference 48 cm., symmetrical; no abnormal depressions or elevations; palate asymmetrical. Intelligence fairly good; recognizes well; emotions explosive; some difficulty in talking.

Chest and Abdomen: Configuration apparently normal, and vegetative organs apparently normal.

March, 1897, nearly two years after examination, showed very marked improvement of speech; child talks now very well. All joints are free from muscular spasticities. Flexion and extension of wrists gone; some flexion and extension of fingers, excepting the index of right side. Absence of supination right forearm; does not use thumbs; can spread fingers and extend terminal phalanges.

Electrical Examination: Flexors and extensors of wrist do not respond to faradic or galvanic stimulus. Some diminution of faradic and galvanic response in muscles of lower extremity—in the peroneal groups apparently total loss. All joints of body excepting those mentioned are apparently normal and do not manifest any signs of laxity of ligaments.

January, 1897, I corrected the right equino-varus by tenotomy and manipulation, and in a few weeks the child walked fairly well—the peculiar gait incident to the dislocated hip alone remaining. Patient died June 1, 1897, of diphtheria.

The specimens I wish to direct attention to chiefly are the forearm and hand of the right side; the pelvis, showing the dislocated hip contrasting with normal right hip; together with a preliminary communication of histopathological findings of brain and spinal cord by my colleagues, Drs. Joseph Fränkel and B. Onuf (Onufrowicz).

Right Forearm and Hand: There is a subluxation of the head of the radius forward. The orbicular ligament is not ruptured, but appears stretched similar to that of the left subluxated hip, to be mentioned later. The head of the radius rests upon the coronoid process of the ulna.

Muscles: Anterior brachial region, superficial layer: Palmaris longus absent—this is frequently absent normally. Pronator radii teres, flexor carpi radialis, and flexor carpi ulnaris, all fairly well developed. Flexor sublimus digitorum, the ulnar half of this muscle sending tendons to ring and little finger, atrophic but not showing fatty change; radial half of muscle composed of fat, apparently no muscular fibres remaining, the original contour of this part of the muscle, now entirely fatty, being clearly defined.

FIG. 1.

Anterior brachial region, deep layer: Flexor profundus digitorum markedly atrophic and fatty. The fatty change increases from ulna to radial side. The ulna quarter sending its tendon to the ring finger is quite muscular; the second quarter less so, the third containing very few muscular fibres, while the fourth, or that connecting with the index finger, is almost entirely composed of fat. Flexor

longus pollicis entirely converted into fat. Pronatus quadratus muscle is apparently normal. Radial region: In place of supinator longus is found nothing but a tendinous band. Extensor carpi radialis longior contains a few muscular fibres, but is chiefly tendinous. Extensor carpi radialis brevior is fairly well developed.

Posterior brachial region, superficial layer: Extensor communis digitorum, extensor carpi ulnaris, and extensor minimi digiti, small, but present no apparent fatty change.

FIG. 2.

Deep layer: Supinator brevis, extensor ossis metacarpi pollicis, extensor secundi internodii pollicis, and extensor indicis, small but absolutely free of fatty infiltration. The extensor primi internodii is wanting.

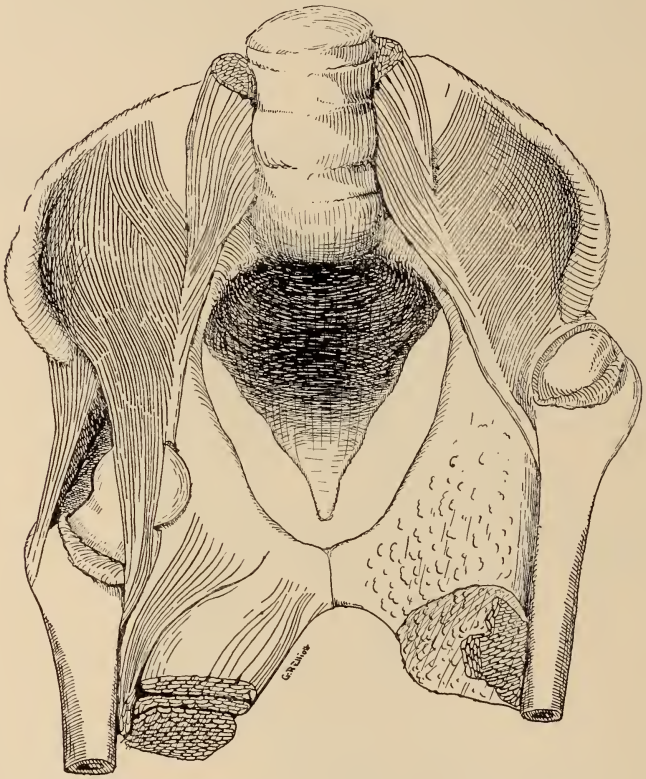
In short, then, it is the flexor group of muscles that we find converted into fat, while the extensors, on the contrary, show nothing of this wholesale fatty change, but exist as small, well-defined muscles.

Wrist: Carpal bones present (see Fig. 1).

Hand: Of the intrinsic muscles those of the thumb are chiefly at fault. All the thumb muscles are absent except flexor brevis pol-

licis, which is fairly well developed. The muscles of the hypothenar eminence, on the contrary, are all preserved. The lumbricales appear normal and well developed. Dorsal interosseii are present; first and second small, but showing no fatty change; third and fourth well developed.

FIG. 3.



Showing dislocated hip (L) and fatty adductor group.

There is a subluxation of left hip upward and forward. The capsule is found intact and thickened, forming, together with a depression made in the ilium, a cavity for the head of the femur (see Fig. 5).

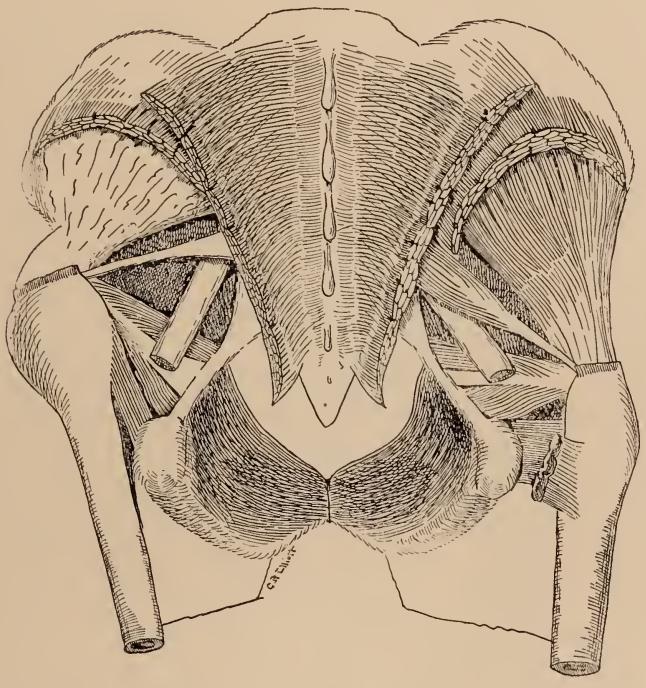
The old acetabulum is well defined, measuring 2 cm. in diameter —that of the right or normal measures $2\frac{1}{2}$ cm. The old acetabular surface is covered with cartilage and its cavity filled largely with a

very much hypertrophied ligamentum teres (see Fig. 5). This ligamentum teres is 4 cm. long, $1\frac{1}{4}$ wide, and 4 mm. thick.

Head of femur is reduced in size, measuring 2 cm. in diameter, covered with normal cartilage; the right head is $2\frac{1}{2}$ cm. in diameter. Neck of femur is considerably shortened.

Both trochanters are well developed. Shaft of femur at a distance of 6 cm. from small trochanter measures 1 cm. in diameter; right, $1\frac{1}{4}$ cm.

FIG. 4.

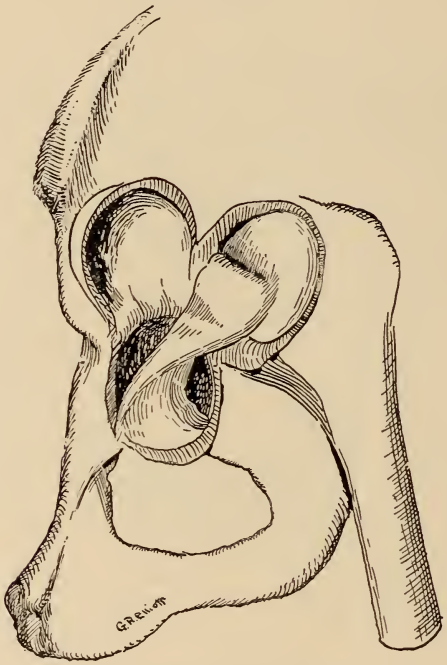


Muscles: The gluteal group is somewhat atrophic and contracted on side of deformity, showing fatty and fibrous changes. The chief changes, however, in this group are found in the gluteus minimus, which is apparently fatty. The pyriformis muscle is converted into a fibrous band (see Fig. 4). It is in the adductor group that we find the greatest muscular changes about the hip. Of this group the inner two-thirds of the adductor longus and brevis are fatty, apparently containing no muscular fibres, the outer one-third is muscular.

The inner one-half of the adductor magnus is fatty, the outer one-half muscular. The biceps and semitendinosis muscles are but slightly involved. The other muscles about the joint are contracted and displaced (see Fig. 4), in keeping with the dislocation, but show no fatty infiltration.

A study of the changes in the central nervous system is being made by my colleagues, Drs. Joseph Fränkel and B. Onuf (Onuf-

Fig. 5.



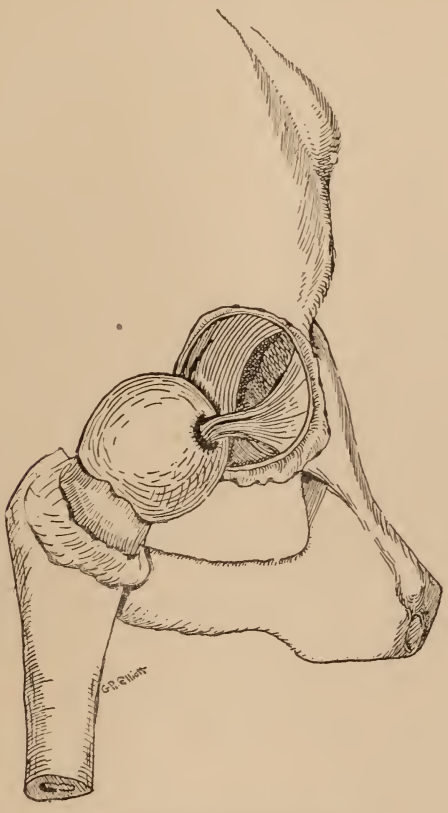
Showing acetabular sites and hypertrophied ligamentum teres of congenital dislocated hip.

rowicz), and at present I am prepared to present only a preliminary communication of their findings.

Child died of gangrenous diphtheria. Autopsy made twelve hours after death, during the hot season, which facts caused post-mortem changes marked enough to exclude the possibility of studying the finer changes in the chromatic structure of the nerve-cells. However, the atrophic changes were distinct enough to be utilized.

The brain and spinal cord were first put in 95 per cent. alcohol, but being rather soft it was found necessary, after twenty-four hours, to put them into Müller's fluid. The parts examined were the spinal cord, some of the anterior spinal nerve roots, medulla and central axis up to the anterior corpora quadrigemina, and the cere-

Fig. 6.



Normal right ligamentum teres.

bral cortex of the precuneus, the paracentral lobe, Broca's convolution, various portions of anterior and posterior cerebral convolutions, cerebellar cortex and portions of muscles of upper and lower extremities.

Spinal Cord: Examination showed cellular changes of the atrophic order, together with decided alterations of the bloodvessels and neu-

roglia. The changes affected apparently only the gray matter, the alteration found in the white substance being slight and evidently secondary. The parts chiefly affected were the anterior horns—Clark's columns appeared normal throughout the spinal cord. The anterior horn changes could be found throughout the entire length, but while very slight in some regions they were marked in others.

In the lumbo-sacral region certain cell groups, for instance, showed an exquisite atrophy, while others were normal. The atrophy increased from the second lumbar segment distad, confined chiefly to antero-lateral cell group. There was no total destruction of cell groups. In the sacral cord the changes were more marked. In the second sacral segment the post-post lateral group had almost entirely disappeared. Again, the lower cervical segments showed much more intense alterations than the upper cervical region.

While it seemed at first doubtful whether many of the cellular changes might not be artefacts, the good condition of the cells of Clark's columns and of the cranial nerve nuclei in the medulla and cerebral axis spoke decidedly against this view. A certain amount of shrinkage resulting from post-mortem artefacts cannot be excluded. We may add that the cord changes are not the striking changes of poliomyelitis.

Left anterior nerve roots: Fifth lumbar: degeneration marked. One sees well-stained fibres, but this well-stained part is not more than one-fifth of the total, the balance being markedly sclerotic. The bloodvessel walls show decided thickening. Third sacral: degeneration marked. First dorsal and first lumbar show slight changes. No other roots at present examined.

Brain: Certain parts of the motor cerebral cortex show changes. It may be especially noted that Broca's centre is normal, and here we recall the clinical fact that the speech disturbances manifested by patient were of the dysarthrial rather than of the aphasic order.

Left anterior central convolution: large pyramidal cells of middle portion show slight changes.

Left posterior central convolution: decided alteration of large pyramidal cells, which are elongated, twisted with corkscrew apex processes. The changes are chiefly in axial part of convolution. The above changes are confined to middle portion of the convolution.

Left anterior central convolution: the inferior portion shows little or no change, while the inferior part of the left posterior central convolution shows slight changes in the polymorphous layer.

The brain-cell changes alluded to above did not seem primary. A detailed account of central nerve findings will be published later, when Drs. Fränkel and Onuf, having completed their exhaustive examination, will express their final views.

What, then, was the primary difficulty with the child? In reviewing the literature I have been unable to find a case reported showing the multiplicity of deformities like the one in question. Kirmisson in his recent excellent work on *Maladies Chirurg. d'Origine Cong.*, 1898, while he relates cases with multiple deformities, does not refer to one of just this type. I think it can be safely stated that if we reason from the hip findings in our patient we are not dealing with a true congenital type of hip dislocation.

Theory of Arrest of Development. There seems no valid reason for accepting this theory to account for the deformities. There is no arrest of development strictly speaking. We have atrophy and the evidence of the disease. The joints are all present and well developed. Let me refer to the acetabulum of the subluxated hip. The acetabulum is developed, and I see no reason why it should not be developed. Much has been written regarding cessation of acetabular development in congenital hip dislocation owing to disease. Professor Lorenz lays great stress on the development of the acetabulum when the head of the femur has been replaced. I do not wish to deny that such development is favored after reposition; in fact, I believe I have observed it in my own cases. But in the present case we know that the acetabulum has not been in use since late fœtal life or very early infancy, yet note how well it is developed (see Fig. 5). We need not look far for a physiological reason. A muscle atrophies from disuse owing to a clearly defined physiological law. The acetabulum, unlike the muscle, plays a more or less passive part. If its three centres of ossification exist development will go on in spite of its not being called upon to play its receptive part.

An explanation of our findings in the case under consideration will be found, I believe, in following out one or both of the following theories:

1. Vicious attitudes during intra-uterine life, chiefly of traumatic origin.

2. Primitive alteration of the central nervous system.

The clinical evidence and post-mortem findings support chiefly the nervous theory.

Let us see. Entire muscles are converted into fat. Two-thirds of the left adductor group are wanting. We find muscular fibres replaced by fat. Right here is to be found the explanation of the subluxated hip upward and forward, and not, as usually found, on the dorsum ilii. With the adductor group paralyzed a very slight traumatism would produce subluxation. There is nothing else about the hip that could not arise from the new position and disuse.

Entire muscles are absent in the forearm, their fibres replaced by fat, with original muscle outline preserved. The superficial and deep flexor groups are largely fatty. The flexor longus pollicis, too, stands out a mass of fat.

On the other hand, certain flexor muscles, like the entire extensor group, have undergone no fatty change. With the complete drop-wrist the extensors certainly have not been called upon to do work. They are small, to be sure, but show apparently nothing beyond the usual homogeneous atrophy of disuse. If flexor group above-mentioned are fatty through disuse, why not all the flexors; why have some escaped? It is impossible to conceive of the total fatty transformation of singled-out muscles as here being due to anything but a central cause.

Further, supination was absolutely impossible, yet the supinator brevis muscle is fairly well preserved. It appears like the other muscles that are small, but not fatty, and speaks conclusively against the theory of disuse.

At this stage with such positive findings it may be asked, why not settle it at once and tell us whether or not commensurate central changes exist. To this I reply, the preliminary communication of Drs. Fränkel and Onuf, already referred to, does not detail alterations marked like those of poliomyelitis. Great care in staining was required to bring out the changes. Changes do exist, however, changes allied to those found in certain cases reported by Courtillier, and warrant the statement that they are primary central nerve-cell changes rather than the secondary degeneration of Gudden. We

believe the completed study of Drs. Fränkel and Onuf will fully confirm this statement.

To account, then, for this striking example of multiple deformities, we venture to enlarge upon a theory proposed by Courtillier in his studies upon intra-uterine life, and say that a toxin selective in character affected certain central nuclei. Muscles weakened in consequence were not able to rebound from a forced intra-uterine position.

The central disturbance, then, plus the disuse favored by the real intra-uterine position, we believe, suffices to explain the multiplicity of deformities manifested by our little patient.

DISCUSSION.

Dr. Fisher was invited to open the discussion. He said that the case was certainly a very unusual one. The two conditions which suggested themselves were: 1. Congenital multiple neuritis, and 2, a diffusion lesion affecting the spinal cord. The former had never come under his observation. Neuritis occurring very early in childhood, especially among races using alcohol largely, gave a picture not dissimilar clinically from that seen in the present case. It was possible to have secondarily a lesion affecting the spinal cord. He believed the case was one of diffuse inflammation of the whole cord—not merely of the anterior horns. Such cases of myelitis *in utero* had been recorded.

Dr. Onuf spoke of the difficulties of studying such a case anatomically. In the first place the post-mortem changes must be considered, and this was especially true of the present case, as the child had died of a gangrenous diphtheria, and the organs were in a softened condition at the time of making the autopsy. Another difficulty was to distinguish the secondary from the primary changes. When one found atrophy of cells in the spinal cord or brain it was sometimes extremely difficult to say whether they were primary or secondary. At first he had been inclined to look upon the changes here as secondary, but the fact that they were distributed over the

whole anterior horn seemed to point rather to their being primary changes. Slight atrophy of muscles could be explained by disuse, but if there were fatty degeneration of certain muscles it could hardly be explained in any other way than by supposing that they were primary. Some of the motor regions seemed to be free from alteration, and he was inclined to look upon the cortical changes as secondary.

Dr. Elliott, in closing, said that the theory had been propounded that cases of this kind might be due to a certain toxin circulating in the system and selecting certain nerve-groups. Added to this were the results of disuse.

REMARKS UPON ROTATION OF THE SPINE IN THE SO-CALLED LATERAL CURVATURE.

With the Report of a Case.

By WILLIAM ADAMS, F.R.C.S. Eng.,
LONDON, ENGLAND.

The subject of "rotation of the spine" in the so-called "lateral curvature," its causes and treatment, is one of great practical importance, especially in reference to diagnosis and treatment.

The first occasion on which my attention was drawn to the subject of rotation of the bodies of the vertebræ was on November 13, 1852, when, I being then demonstrator of morbid anatomy at St. Thomas' Hospital, I was requested by the late Dr. Thomas Hodgkins to make a post-mortem examination of the body of a distinguished member of our own profession.

The history of the case showed that his health had been impaired for some years, and in 1842, he being then fifty-two years of age, he suffered from excessive pain in the back, inducing him to apply an opiate liniment and leeches. Then he was thrown from his carriage, striking upon his back, and the symptoms are reported to have been aggravated, and numbness came on in the left foot.

A tumor which had appeared in the left lumbar region rapidly increased, with supposed fluctuation. During a period of nine months Drs. Hodgkins, Liston, Brodie, Bright, Lawrence, Stanley, Coulson, and others were consulted. Meantime the tumor became slowly harder, and almost disappeared.

The cachectic appearance of the patient led to the suspicion of the formation of a malignant tumor in connection with the bodies of the vertebræ, an idea which was subsequently abandoned, but in his own journal the doctor notes his health as broken up.

To relieve intense suffering he sometimes resorted to anodynes. On the last occasion a dose of this kind, believed to have been taken on an empty stomach, produced the symptoms of narcotic poisoning, which proved fatal, and he died on November 10th, aged sixty-two years.

The above remarks are abstracted from Dr. Hodgkins's observations when the specimen was exhibited to the Royal Medical and Chirurgical Society, on June 27, 1854. (See vol. xxxvii. of the *Medical-Chirurgical Transactions*, 1854.)

Morbid Anatomy of Rotation. The appearances met with on dissection are so accurately and minutely described in the second edition of my larger work on *Lateral and Other Forms of Curvature of the Spine*, 1882; *Lectures on the Pathology and Treatment of Lateral and Other Forms of Curvature of the Spine*, London, Churchill, 1882, that it would be superfluous to enumerate them in detail in this paper, but they may be summarized according to the structures primarily and secondarily involved, as follows:

1. The *intervertebral cartilage*. This structure is the first to suffer from unequal compressiou, and gradually becomes wedge-shaped, and in severe cases the cartilage is completely destroyed at the apex of the wedge.

2. A little later the ossoous structure of the bodies of the vertebræ also suffers from unequal compression, and in the concavity of rotation-curve the bodies of two vertebræ become diminished in thickness.

3. Simultaneously with these changes in the intervertebral cartilages and the bodies of the vertebræ very important structural changes take place in the oblique articulating processes, the articulating surfaces of which become altered in direction, and a nodulated marginal ridge of bone is thrown out along the edges of the articulating surfaces, very like that which occurs in chronic rheumatic arthritis.

4. Structural alterations also occur in the transverse processes in the lower lumbar region more especially—severe cases occurring in adults. The transverse process of the fourth lumbar vertebra on the left side was remarkably altered both in direction and form, and curved upward as a horn-like process, approaching the transverse process of the third vertebra.

There can be no doubt that this transverse process rested upon the crest of the ilium, articulating with it, as it were, by its expanded extremity, the under surface of which presented a shallow cup-like depression, coated with a thin layer of fibro-cartilaginous substance, giving to it the well-marked character of an articular surface.

The transverse process of the fifth lumbar vertebra was sawn through in removing the parts, but it must have rested on the crest of the ilium and had become greatly altered in form and position.

In making the section through the sacrum it was, unfortunately, not possible to include that portion of the crest of the ilium corresponding to the fourth and fifth transverse processes of the lumbar vertebræ. The specimen is now in the Museum of the Royal College of Surgeons.

The great practical lesson which this case taught me was that a large internal curvature of the bodies of the vertebræ—properly described as horizontal rotation of the bodies of the vertebræ—may exist without any lateral deviation of the apices of the spinous processes, upon which surgeons always rely in the diagnosis of lateral curvature.

Not one of the eminent physicians and surgeons who examined the case suspected the existence of lateral curvature or rotation of the bodies of the vertebræ. The general opinion seems to have been that destructive disease of the spine existed in the lumbar region, accompanied with lumbar abscess, which one surgeon—Mr. Liston—proposed to open. Sir Benjamin Brodie, however, advised delay. The operation would probably have killed the patient.

This condition of the spine, described as transverse or horizontal rotation of the bodies of the vertebræ, without any lateral deviation of the apices of the spinous processes, does not appear to be recognized by modern authorities; but it appears to have been accurately observed by the late Dr. Dods, of Bath, who, as far as I know, was the first to direct the attention of the profession to the subject of rotation of the bodies of the vertebræ in lateral curvature.

In the year 1824 Dr. Dods published a somewhat remarkable work entitled *Pathological Observations on the Rotated or Contorted Spine, Commonly Called Lateral Curvature.* Dr. Dods practised by friction and manipulation, in the course of which he observed the

transverse processes arising to the level of the apices of the spinous processes, and came to the conclusion that this could only result from a movement of transverse rotation of the bodies of the vertebræ.

From an observation by Sir B. Brodie in a clinical lecture delivered by him in December, 1846, and published in the *London Medical Gazette*, it would appear that M. Guérin was familiar with this condition. Sir B. Brodie observes, "At a very early period, and even before the lateral curvature is very distinct posteriorly, the bodies of the vertebræ are actually twisted to one side. This curious circumstance was pointed out to me by M. Guérin, who has some preparations in which the fact is perceptible." He was evidently aware of the existence of rotation of the bodies of the vertebræ.

Then as to the *causes* of lateral curvature; these may be arranged into *predisposing* and *proximal; hereditary tendency* is the chief predisposing cause, and *rickets* probably next in frequency.

The *proximal* causes are essentially local, and act mechanically upon the spinal column, such as inequality in the length of the legs from any cause.

In cases of the so-called congenital dislocation of the hip, when affecting one side only—unilateral displacement as we call it. This affection was first demonstrated in England by a distinguished American surgeon, the late Dr. Carnochan, of New York, in the year 1848, who showed a case of double congenital dislocation to the surgical staff of St. Thomas', in my curator's room, a case eighteen years of age. In this case the spinal curvature was in the antero-posterior direction, but in the unilateral displacement lateral curvature always occurs.

The superincumbent weight in heavy people, and the long continuance of the sitting position, would be a proximal cause, and probably contributed to the increase of the rotation in this case.

Treatment. With regard to the treatment in all cases of spinal curvature, when structural changes have gone so far as to involve the intervertebral cartilages and the bodies of the vertebræ, they become at once incurable, and the only relief to be given is by recumbency, more or less complete for at least six hours a day, either in a straight-backed reclining-chair at an angle of forty-five degrees, or on the prone couch, on which the patient can read, write, paint, and draw.

Mechanical supports are useless, except in some light form of retentive apparatus, which may relieve the pain and tend to preserve the equilibrium of the body. The *diagnosis* as to the commencement of the structural changes is easily made by the posterior projection of the angles of the ribs in the dorsal region and of the transverse processes in the lumbar region.

In an earlier, and more or less physiological condition, muscular exercise, especially in the horizontal position, may be added, together with head-suspension upon Dr. L. Sayre's plan.

THE TECHNIQUE OF OSTEOTOMY, WITH THE DESCRIPTION OF A NEW OSTEOCLAST.

By GWILYM G. DAVIS, M.D.,
PHILADELPHIA.

It is desired to direct attention to two points: first, the location of the bone incision in performing osteotomy, and second, the desirability of using an osteoclast in preference to manual force to complete the correction of the deformity. The proposition advanced is that in linear osteotomy the section should be made on the concave and not on the convex side of the bone. The operation of linear osteotomy is probably most often performed on the femur for genu valgum. The procedure almost universally advocated is that of Macewen; in it the bone section is made on the inner or convex side of the curve. Bradford and Lovett, writing in 1890, say (p. 670): "By nearly all operators of large experience, who have no operation of their own to advocate, the superiority of the Macewen operation is admitted." Moore, in his *Orthopedic Surgery* (p. 190), says it makes no difference as to whether one operates from the inner or outer side, for with the knee flexed the femoral artery is out of the way. Henry A. Reeves advocated external division, but he made it at the junction of the middle and lower thirds of the femur. MacCormac (*Antiseptic Surgery*, 1880), and Brenner (*Medical Press and Circular*, February 29, 1888), however, advocated practically the Macewen operation done from the outside instead of the inside, and I agree with them. The objection to a division on the convex side is that a more extensive cut in the bone is required, thus increasing the danger of accidently wounding the surrounding structures, and also when the bone is straightened the remaining undivided portion is broken, and therefore the two fragments are entirely separated. This is necessarily the case even in children. When, on the contrary, the bone is divided on the concave side the undivided portion of the bone and periosteum act as a hinge, and in young subjects particularly it bends rather than breaks, and therefore serves as a bond of union

which, while preventing undue displacements, still does not interfere with the removal of the deformity. The too free separation of the fragments is apt to give rise to excessive formation of callus, and to avoid this was one of Reeves's objects in choosing the external operation. It is also perfectly evident that a much greater force is

necessary if the bone section is made on the convex side. In straightening a curved bone the convex surface is compressed and concave surface receives all the strain ; therefore, if the convex surface is divided the bone is not weakened to anything like the extent it is when the concave surface is divided. After the partial division

of the bone by the chisel the breaking of the remainder of the bone has not infrequently been a clumsy and more or less annoying procedure. For years I have desired some instrument with which, after a partial division of the bone, the curve could be straightened with care and precision, avoiding the liability of injuring the joints near the site of section.

The publication by Dr. W. Barton Hopkins (*Annals of Surgery*, July, 1898) of his operation of osteomoclasis, in which he first made the bone incision, and then, after the wound had healed broke the bone with his osteoclast, stimulated me to devising an instrument for my purpose. The object was to produce an osteoclast which would be rapid in its action and apply its power at the desired point. Extreme force was not desired, because the bone would be weakened by the incision made in it.

As regards the comparative merits of osteoclasis and osteotomy, it is not desired to enter. While aware that with Grattan's perfected instrument the bone can be broken quickly and efficaciously, I dislike to use such a ponderous instrument for surgical purposes. The partial division of the bone locates accurately the site of fracture, reduces the liability to splintering, and in my hands has never been accompanied by suppuration in any place where an osteoclast could be utilized.

The instrument here shown is intended to complete the straightening after the bone has been partially divided with the chisel. Rapidity of action rather than strength was desired, and it is not intended for osteoclasis alone, particularly of large, strong bones. It consists of two bars or handles about three feet long fastened together at one end like the letter V. At or near the point of union a strong pin projects out laterally. Two other pins project likewise from two blocks which slide on the bars and are capable of being fixed at any desired point. In using the instrument it is so placed that the end pin presses on one extremity of the bone on its concave side; the middle pin is slid along the bar until it rests on the convex surface of the bone opposite the point it is desired to fracture; the remaining pin is then placed on the other side of the bone beyond the middle one. In using the instrument either pads may be placed under the pins or they may be covered with thick rubber tubing. The bone is to be snapped by a quick, sharp approximation of the handles.

SOME CLINICAL FEATURES OF RHEUMATOID ARTHRITIS.

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Although rheumatoid arthritis and allied affections are frequently seen by orthopedic surgeons, the Transactions of the American Orthopedic Association do not present a paper on this subject. More or less confusion also exists in the classification of these ailments in the majority of text-books, as they are put with rheumatic and gouty troubles, to which they are not allied, either in their symptomatology or in treatment. Again, we find the periarticular variety, which is the usual one seen in childhood before the second dentition, used synonymously with arthritis deformans, which is secondarily, at least, an osteitis, a formative osteitis, the stage in which we see the majority of cases in old people.

Of the disease known as arthritis deformans, Charcot makes division of the cases into Heberden's nodosities, the general progressive form (which may be seen in childhood), and the partial or monoarticular form.

Still divides the general progressive form seen in children into the periarticular, and into what might be termed the osseous form, which can truly be called arthritis deformans. In the periarticular, Still first called attention to the enlargement of the lymphatic glands and spleen associated with the articular changes.

There is a third affection, according to Still, seen in children, and extremely rare, which Jaccoud called attention to in 1871, and which he termed chronic fibrous rheumatism. The affected joints showed

firm thickening, an extra-articular fibrous hyperplasia, with fibrous nodules present.

From a study of the literature and our own cases we have arrived at a classification which we think will meet the clinical and pathological findings of the majority of chronic bony changes of this character, as follows:

1. Rheumatoid arthritis.
2. Chronic fibrous rheumatism, a sequela of subacute attacks of articular rheumatism.
3. Arthritis deformans, the general progressive form of Charcot.
4. Osteitis deformans of Paget.
5. Heberden's nodosities.
6. Partial or monoarticular deformans.

Of the six classes, a few types of but the first three have been reported in childhood, and these but rarely; especially may this be said of arthritis deformans.

Osler reports of having seen but five cases of arthritis deformans, three of the cases only presenting themselves at his clinics in six years at the Johns Hopkins Hospital.

Koplik has reported one case of the same, and Henoch only five, and ranks them as the rarest form of joint affection in children. Koplik states there are only eighteen cases in children of the classical arthritis deformans in the literature—that is, including those causing only partial disability and ankylosis, so that we can infer from this that some of these cases may fall in the category of rheumatoid arthritis. The Charcot type of arthritis deformans must be bilateral in its invasion of its joints, cause enlargement of the ends of the bones, together with the effusion into the joints and deformity. In one of Osler's cases, reported at length, only one elbow, one knee, both feet, and the cervical spine were involved, the liver was a little enlarged, and the spleen was just palpable.

Taking up, then, our separate classes we find the following points of distinction:

1. Rheumatoid arthritis occurs more frequently in girls than in boys, before the second dentition, and attacks the periarticular tendon sheaths, capsules, and synovial membranes. It is usually bilateral in its distribution. It rarely, if ever, exhibits any abnormality in the bones or cartilages, and has further as a distinguishing feature

E. C. Rheumatoid arthritis, showing especially the fusiform enlargement around wrist and interphalangeal joints.

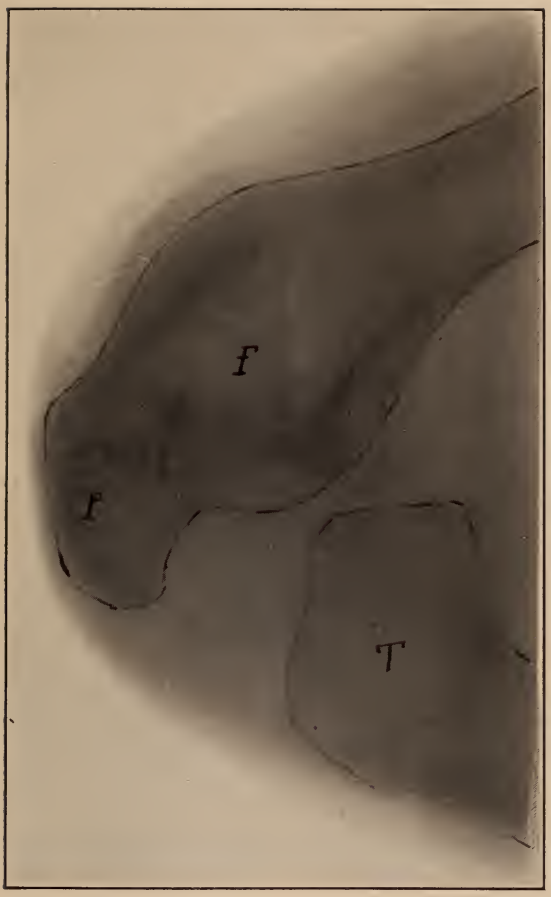
E. C. Rheumatoid arthritis. Skiagraph showing absence of bony changes.

M. T. Arthritis deformans, showing the proliferative osteitis at the metacarpo- and interphalangeal joints.

E. C. Rheumatoid arthritis, showing "position of flexion" of thighs on pelvis.

E. C. Rheumatoid arthritis, showing slight exophthalmos and enlarged wrists.

E. C. Rheumatoid arthritis, showing extreme limit of extension of cervical spine.



N. H. Fibrous Rheumatism, showing adhesion between Patella (P) and Femur (F). Tibia shown at T.

the enlargement of the lymphatic glands and the spleen, which is not seen in arthritis deformans. The onset is usually gradual, with pain and stiffness complained of in one or more joints, which gradually become enlarged, and the adjacent muscles undergo atrophy.

Generally, the order in which the joints become affected is, first, the knees, then the wrists and cervical spine, with subsequent involvement of the ankles, elbows, and fingers. The temporomaxillary and sternoclavicular joints rarely give evidence of trouble.

The enlargement appears as a general thickening of the tissues around the joints rather than a hyperostosis. This swelling is smooth and fusiform, and does not exhibit the bony irregularity of arthritis deformans. No bony grating is ever felt, but often creaking is observed and fibrous adhesions in the synovial membrane. There is usually flexion, and always some limitation of motion in the diseased joints. Stiffness does not decrease as the day advances and the joints are used. Except in extreme acute cases no redness, joint-heat, nor tenderness on pressure is present. There is pain on active movement, especially when forced hyperextension is attempted; with passive motion usually the pain is slight or absent. "Night-cries," such as are seen in tubercular joint-diseases, are by no means rare during the active stage.

In rheumatoid arthritis in the hands and feet the tarsus or carpus is first involved, and in arthritis deformans the metacarpophalangeal or metatarsophalangeal articulations.

One of the characteristic features of rheumatoid arthritis is the eventual involvement of the cervical spine, with limitation of motion of the head in extension and rotation.

In the hand in the latter are slight flexion, usually at the wrist, with more or less deviation of the hand to the ulnar side, slight flexion of the proximal, combined sometimes with slight flexion of the distal interphalangeal joints. There may be hyperextension of the metacarpophalangeal or of the interphalangeal joints. Also, there may be slight flexion of the metacarpophalangeal and slight hyperextension of the distal interphalangeal joint in the same finger. The deviation of the fingers may be to either side; both directions may be seen in the same hand without bony change. There is never any tendency to suppuration in the affected joints nor bony ankylosis. Without doubt the most characteristic feature of this condition is

the involvement of the lymphatic glands and spleen. The glands chiefly enlarged are those near the affected joints. They are separate, hard, painless, and have no tendency to break down, but the swelling of them appears to increase or diminish according to the activity of the process around the joints. Those usually hypertrophied are the epitrochlears, the axillary, the inguinal, and posterior cervical. The face has often a peculiar waxy pallor, and the skin, especially of the extremities, may have a mottled appearance, as if from a defective return circulation.

The eyeballs show in some cases a slight exophthalmus—hardly more than to be just noticeable.

Sweating is frequently profuse; it bears, however, no relation to the temperature, which is usually of two varieties: one, in which the fever is slight and lasts only a few days, and is followed by a longer period of apyrexia; the other, in which there is a more or less continuous slight apyrexia. As the sweating has no connection with the fever, so is the fever independent of the periodical exacerbations around the joints.

This disease, like those correlated, is still a mystery in its etiology, and treatment is of but little avail in checking the extension or of curing it, and it is fortunate that the condition is one of such rarity. It is generally acknowledged, except by Garrod, that the etiology bears no relation to that of rheumatism or gout, and remedies so efficacious in these troubles have no effect on rheumatoid arthritis. There is no cardiac involvement in the latter. Charcot, J. K. Mitchell, and Osler seem inclined to believe in a neurotic origin, from the trophic lesions, atrophy, etc.; but these Still considers the atrophy of disease and peripheral disturbance of function, as we see in tubercular joint-affections. Faruier considers late hereditary syphilis an important etiological factor. Strümpell states positively that in one case in which he made a careful microscopical examination of the spinal cord the results were entirely negative in supporting the neurotic theory.

Now, as to the points in differential diagnosis of this condition from allied affections we could call attention to the following:

2. Chronic fibrous rheumatism is a sequela of repeated subacute attacks of acute inflammatory rheumatism, and is most common among the poor and those who have passed the middle period. In

long-standing cases the cartilages undergo erosion and the capsules and ligaments of the joints are thickened. There is muscular atrophy, stiffness, and pain, the latter very liable to exacerbations. There are often valvular lesions, but no enlargement of the lymphatic glands or spleen, and the joints are tender to the touch. "Even in cases with the severest symptoms the joint may be very slightly altered in appearance" (Osler).

3. Arthritis deformans—the general progressive form of Charcot—is more commonly seen in the aged, beginning chiefly in women at the menopause. It is known in children, however. The disease, while beginning in the synovial membranes and cartilages, the cells of which proliferate, shows its chief pathological and clinical feature in the production of osteophytes, where the joint-pressure is least, causing a false ankylosis eventually by the exostoses locking the joint. The shape of the joint is entirely changed, especially in the hands and feet. Atrophy is present, and pain may be intense for years during the exacerbations, requiring morphine. Contractures are frequent; trophic and circulatory changes often occur. In many cases, after two or three joints are involved, the disease becomes arrested, and no further development takes place. The majority of cases reach a quiescent stage. The cardiac symptoms are absent, as are the glandular.

4. Osteitis deformans of Paget consists chiefly in the softening and thickening of the shafts of the long bones of the lower extremities and marked kyphosis, and shortening of the spine, with huge thickening of the vault of the cranium. It is more common in old men.

5. Heberden's nodosities show hard tubercles on the distal or second phalanges of the fingers, occurring in middle-aged women, more frequently in those who have a tendency to cancer. The joints are red, tender, and swollen; the cartilages may become soft, and the ends of the bones eburnated. The joints show no tendency to involvement. A gouty diathesis does not necessarily coexist.

6. The partial or monoarticular form is seen only in old age, and more commonly in old men, as morbus coxæ senilia or spondylitis deformans, or in the variety affecting the shoulder. It not infrequently seems to follow some injury.

The following case of rheumatoid arthritis has been in the wards of the Hospital for Crippled and Deformed Children:

E. C., aged eight years, is the daughter of an indigent mountain farmer, who died of "hemorrhages of the bowels, and had white swelling of the ankle." Her mother is living and well. The other children in the family are healthy. The patient enjoyed good health in infancy and childhood, having none of the exanthemata. One year before she was presented at the hospital she was suddenly seized with swelling of the ankle and knees, followed by pain and stiffness. Her hygienic surroundings and food were poor, pork being the chief meat available, and she had to walk a mile to school, frequently through the mountain snows. Her appetite continued good, but she lost flesh. At no time was it thought she had fever. Her treatment consisted chiefly of cod-liver oil. On admission to the hospital on September 1, 1898, the girl gave the appearance in gait of a case of double tubercular hip disease, with rigid flexion and adduction of the thighs. Locomotion was effected chiefly by a shuffling gait at the knees. On examination both thighs showed marked muscular spasm in the adductors, quadriceps extensors, and tensores vaginæ femoris, with pain on attempted motion. Thighs held in a position of flexion of 45°, with perhaps 5° of adduction. Thighs and legs atrophied, malnutrition and anæmia noted. Double Buck's extension and traction in the line of the deformity (45°) was made with ten pounds on each leg. Salicylate of sodium, gr. v, was given t. i. d.

September 15th. Improvement noted in position of flexion to 20°. Child suffers most pain at night, and has "night-cries."

October 18th. Child still emaciated, notwithstanding forced feeding. Lips fair color; chest constricted and elongated; apex-beat in fourth interspace within nipple line. Palpation shows heart-beat rapid; no thrill. Percussion gives no increase in cardiac, splenic, nor hepatic dulness apparently. All the joints are thickened and flattened (made conspicuous by the muscular atrophy), including the phalanges and fingers. Muscular spasm and limitation of motion at the wrists and fingers, as well as at the hips. Left wrist is especially stiff. Elbows have caused most pain of late; shoulder-joints comparatively free of involvement. There is still a position of flexion of 20° at the hip-joints, with only about 5° of motion in flexion and adduction, and no motion in abduction and rotation. The knees cannot be flexed beyond a right angle without causing great pain. Knee-jerk a little more active on the left than on the right side, but

it is not distinctly abnormally increased, although ankle clonus on the left side is extreme. On the right side ankle clonus is rather hard to demonstrate, but it is present. Motion is also limited at the ankle-joint.

In November the child had a mild uncomplicated attack of scarlet fever, which was traced to a school-book donated by a friend.

January 18, 1899. Urine analysis showed clear amber, acid fluid, specific gravity 1038, but no sugar nor albumin. Microscopic examination negative; previous and subsequent examinations likewise have shown nothing abnormal.

February 6th. Nutrition and general condition improved since admission. Child complains that joints are more painful in bad weather. "Night-cries" present (continued one to three a night until April). Pulse, 132; poor tone. Has been etherized three times and joint adhesions broken up without apparent improvement. Also has had high heating in Lentz-Stanley apparatus to 300° F. for half an hour and massage (general and special) nearly daily, with the exhibition of iodide of potassium, sodium salicylate, arsenic, and cod-liver oil with iron, by turns, without apparent gain to the arthritic symptoms.

Examination of viscera and joints give some signs, as in previous notes, with the addition that the spleen is just palpable. The post-cervical, submaxillary, inguinal, axillary, and epitrochlear lymphatic glands are much enlarged. The hips have lost a little in position of adduction and flexion. The wrist-joints are swollen on the posterior and radial aspects especially, and motion is limited in extension, adduction, and abduction chiefly, and is painful. Swelling of the interphalangeal joints has increased. The appearance of the skin is rather pale and mottled. The arches of both feet are good, but their adduction and pronation cause a prominence of the internal malleoli.

Blood Examination. Fresh specimen showed good normal color to reds. Slight leucocytosis (apparent). One area in specimen showed a clump of four or five eosinophiles together. With this exception the eosinophiles seemed to be in the normal ratio. More polymorphonuclear leucocytes were seen than any other type. The stained specimen showed, after heating on copper at 200° F. for half an hour and staining with Ehrlich's triple stain for two and a half minutes:

Polynuclear neutrophiles	63.6 per cent.
Small mononuclears	22.0 "
Large mononuclears	6.4 "
Transitional cells	4.2 "
Eosinophiles	3.8 "
Total	100.0 "
Hæmoglobin	87.0 per cent.
Red blood-corpuscles	5,052,000 per c.mm.
White blood-corpuscles	12,000 "

The eosinophiles are at the extreme limit of normal, and their granules are unusually large and take a very brilliant eosin stain. We have been, however, only able to infer from the blood examinations that a slight secondary anæmia exists, with slight eosinophilia.

May 20th. The heating and massage have been continued, and the carbonate of guaiacol has been given in three-grain doses thrice daily, and the affected joints have been painted once daily with equal parts of guaiacol and olive oil.

About ten days ago, under ether, an incision was made on the dorsum of the right wrist down through the capsule and into the joint. The capsule appeared somewhat reddened perhaps, but the bones seemed normal. Attempts at culture in bouillon gelatin and agar of some of the joint fluid gave negative results, as did also a microscopic examination of a fresh portion of the capsule.

Status Præsens. The temporomaxillary, sternoclavicular, and shoulder-joints seem normal; but for the past six weeks the limitation of motion in the neck has been noted. The head can be flexed to the sternum, but not extended beyond 90°; rotation of 30° only is possible to the right and left. The elbows cannot be fully extended, owing to muscular spasm and some thickening over the head of the radius. The right epitrochlear gland is 5 x 10 c.mm. in diameter, and the left is double and even larger than the right. The wrist-joint is swollen both from side to side and from before backward. The carpus is slightly flexed on the forearm, and the metacarpus is extended on the carpus, which, together with the atrophy of the interossei mucles, gives the appearance of flattening. The phalanges are flexed on each other and at the metacarpophalangeal articulation. All of these last-named joints are much thickened and boggy in feeling. Very slight exophthalmus is noted. The spleen cannot be

felt, but the glands mentioned in previous note still hypertrophied. Position of greatest ease is with thighs flexed 30° and adducted 10°. Ankles much thickened at and below malleoli, and motion at mediotarsal joint painful and restricted. Motion at metatarsophalangeal joint of the great toes only causes pain, and is limited. Other conditions about the same as previously noted. Sweating has never been a prominent symptom, and the temperature has ranged from 99° to 100° F.

The photographs and skiagraphs of this case show the condition of the hands fairly well, and the emaciation and local atrophies. A comparison of the skiagraphs of the hand of the old case of arthritis deformans presented herewith, with that of the case of rheumatoid arthritis, will show the different osseous conditions and shapes of the member. Our skiagraph of an old case of chronic fibrous rheumatism, dating from childhood, shows well the adhesions between the femur and the patella.

Through the kindness of Dr. W. T. Watson we are enabled to present his photographs of the case of osteitis deformans he published in the *Johns Hopkins Hospital Bulletin* of June, 1898.

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INJURY TO ELBOW; FRACTURE DISPROVED BY RADIOGRAPH.

Dr. L. A. Weigel presented a young woman who had been injured by a bicycle accident last August. Some days later she had been brought to him to have a radiograph made. This showed that the elbow was infiltrated, and accordingly the joint was kept at rest for a time. He had lost sight of her then until the present time. Although the radiograph had proved the absence of any fracture, her physician had insisted that there was a fracture which had been overlooked, and had accordingly anæsthetized her, and was said to have refractured it. Another surgeon of eminence in New York City had also stated that there had been a fracture. In view of the evidence afforded by the skiagraphs exhibited to the Association, and the fact that she had had 20° or 30° of motion when last seen by him, he could not but think that the present very limited motion was the result of the violence to which the joint had been subjected since her return to New York City.

EXTREME RECURVATUM.

Dr. V. P. Gibney presented a boy of six years who had not been able to walk until six months ago, or when five years and a half old. There was extreme recurvatum as he stood, which was not so apparent when walking. The case had been studied with a view to transplantation of muscles.

DISCUSSION.

Dr. G. G. Davis said that the case seemed to be the result of a relaxation of the ligaments of the joints, perhaps in early childhood, while there was infantile paralysis or rhachitis. He would be inclined to use an apparatus with a stop-joint, so set that there would

be no tendency for the child to stumble or fall. By thus preventing anterior flexion the walking should be improved, and in the meantime the ligament would contract.

FRACTURE OF THE FEMUR, WITH ABSENCE OF THE USUAL SYMPTOMS.

Dr. C. L. Starr, of Toronto, said that when he had sent in the title found on the programme he had felt sure of his diagnosis (separation of the upper epiphysis of the femur), but the child having died from diphtheria subsequently, he had found by post-mortem examination that there had not been a separation of the epiphysis, but a fracture just beyond the junction of the head and neck. The case was interesting, in that the child, who was three years old, had a history of having limped for only two weeks. When first seen there had been the typical limp of a congenital dislocation of the hip. There was no complaint of pain and no history of injury. He had learned after the post-mortem examination had been made that the child had had a fall out of a high chair six weeks previous to the time when the limp was said to have begun. It was probable that there had been first an impaction, with subsequent displacement of the fragment.

OPERATIONS ON OLD SUBCORACOID DISLOCATIONS.

Dr. J. D. Griffith, of Kansas City, said that he had made an open section on three cases of subcoracoid luxation, making the incision just along the line of the cephalic vein. In the first case it had been seven and one-half inches in length, and yet, after manipulating the parts for a long time, he had been unable to reduce the dislocation. Finding that the long head of the biceps was an obstacle to the reduction, he had severed it, and then with a blunt-pointed periosteotome he had been able to throw the head into position. He had had to do the same thing in the second case, and with a long and specially curved periosteal elevator had been able very easily to replace the head of the humerus after having severed the long head of

the biceps. He had not the slightest doubt that the deaths reported in such cases had been due to the violent manipulation and extension that had been practised in these old dislocations after having opened into the joint. There had been no subsequent trouble from the division of the head of the biceps.

DISCUSSION.

Dr. G. G. Davis said that he had operated upon one of these cases which had existed for at least eight months. It was a subglenoid dislocation, and he had found that the muscles above the scapula were dragged down over the glenoid cavity and held there firmly. He had loosened nearly three-fourths of the attachment of the pectoralis major, so as to secure better access to the cavity, and had then divided the attachments of the supraspinatus and infraspinatus to the greater trochanter. This had enabled him to reach the head of the bone. He had then divided the capsule around and below the head of the bone on its under surface. The long head of the biceps tendon was clearly exposed, but to what extent it had acted as an obstacle to the reduction he was unable to say. After having divided the capsular attachments he had been able to throw the head of the bone over and burrow out a new socket. He had not in this instance divided the long head of the biceps. The subsequent motion in the joint had been quite restricted.

Dr. Griffith said that if Dr. Davis had gone more anteriorly into the muscle he would have discovered why the pectoralis major had been under such tension. In each of his own cases the muscles attached to the greater tuberosity had been torn off. When the long head of the biceps was cut the pectoralis major would not seriously interfere with the reduction.

REPORT OF THE COMMITTEE ON RECORDING LATERAL CURVATURE.

In recording cases of lateral curvature it is desirable not only that accuracy be attained, but that the means used be easily obtained, and not so expensive as to be beyond the reach of many surgeons.

Arrangements requiring especial skill of adjustment are undesirable, as they necessarily give rise to variation in records of the same patient by different observers.

Measurements or records requiring the patient to stand in one position for many minutes are liable to be inaccurate in lateral curvature, as it is difficult in a second examination to secure the position taken by a fatigued patient at the end of the previous record.

Records of the back of the patient in the recumbent position are to be preferred to those in a standing one, as it is difficult to secure a fixed position of the patient when standing, from the muscular support of the superimposed weight of the trunk and head, a weight not entirely overcome by endurable suspension, but removed by recumbency.

Records of the standing patient, however, indicate habitual attitudes of patients and the amount of the sag of the spinal column under the load of the superimposed weight.

The record in the recumbent position indicates the amount of fixed change in the column and trunk, osseous or ligamentous. The difference in the curve in standing and lying indicates the amount of flexibility or rigidity of the curve.

Records are therefore required in the recumbent and in the standing position, as well as of the amount of rotation.

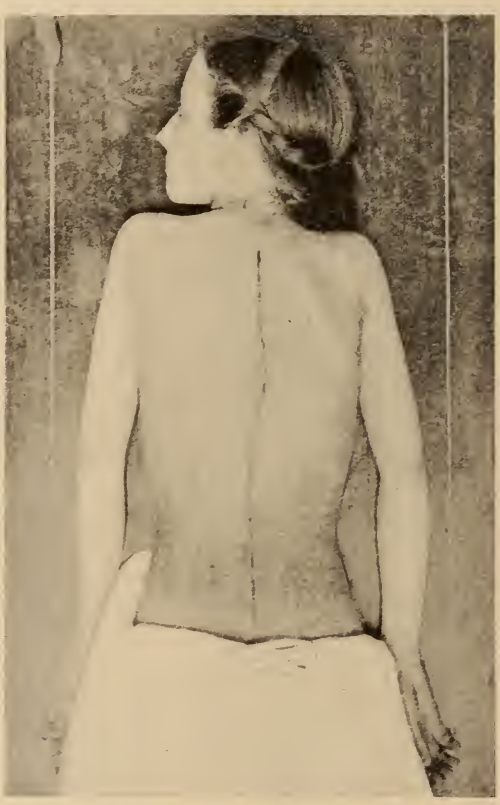
As no method of recording lateral curvature is absolutely accurate, it is desirable to determine the limits of error of each method, and to reject those offering larger chances of error.

The committee has tested many of the usual means of recording

lateral curvature, by comparing the records of a given patient made by a number of independent examiners.

The limit of error was found so great in most that the methods are not to be recommended for general use, although many could be of service for individual examiners in personal examinations, though not available for the comparison as to the results of different methods of treatment.

FIG. 1.



Patient lying on the floor (photographed from above).

PHOTOGRAPHIC RECORD.

Photographic records are of value provided they are carefully taken. The patient's back should be marked on the spinous processes, and also on the central line. The patient should be placed,

standing, directly in front of the camera in a full light with proper background, and the pelvis steadied, to prevent swaying; the arms should hang naturally.

Photographs can be taken of the recumbent position if the patient be placed upon the floor, face downward, in a designated position,

FIG. 2.

Patient standing

with the spinous processes and central line of the spine marked. The camera is to be placed directly above the patient.

Errors in photography occur if the patient does not stand squarely in front of the camera, or if not lying as flat as possible; also if he assumes, in standing, a strained or altered position, and not the

position that is habitual or easy, and if shadows distort the contour.

Photographs can be used to indicate the extent of the rotation, if the patient is placed flat upon a board which is so arranged that the projecting head drops, and the camera placed in such a way that the length of the patient's back is viewed looking from the head downward as along a gun-barrel. A cross-line should be marked on the

FIG. 3.

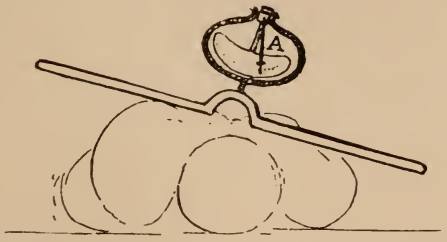
Patient lying on face.

skin at the point of greatest rotation, and the patient placed by raising the board or lowering the camera in such a position that this line is sharply projected against the background, which should be properly arranged by suitable hanging.

A flat steel bar twenty inches in length, of sufficient thickness and weight to stay in position, is to be placed crossways upon the back. It is best made with a slight curve in its middle, to avoid striking the prominent spines. From the central point a rod pro-

jects, to which is attached an arrangement similar to the mariner's quadrant, marked off in degrees. The patient is placed face downward flat upon a board, the shoulders and the anterior spines being

FIG. 4.



Pendulum A indicates, on marked arc connected with bar placed on back, the degree of rotation.

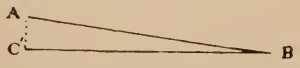
pressed down upon the board; a cross-line is marked upon the back at the point of greatest rotation, and the iron bar rests upon the back at this line; the recording needle of the quadrant indicates the

FIG. 5.

A B, measured bar across back
A C, B D } vertical to plane on which patient lies.

amount in degrees of the inclination of the cross-bar. A spirit-level can be attached to the swinging pendulum, in order to attain greater accuracy.

FIG. 6.



A C′ = A C–B C, and is a measure of rotation.
A B C′, angle of rotation.

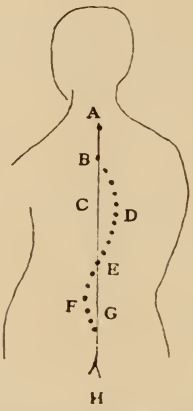
If a light steel rod is laid across the back at a designated point, at its most rotated position, the photograph of this will serve as a record of the greatest rotation.

It is desirable to have, as a control of photographic records, other

means of recording, not dependent upon a camera, and the method recommended by Kirchoff, and somewhat modified by Brackett, appears to be both simple and reliable.

This may be described as follows: A cord is passed around the neck through a loop, so that, hanging, it drops from the spine of the vertebra prominens and hangs downward. It should be secured at the vertebra prominens and the other end placed at the fold of the buttock. An assistant should mark the line of this string with

FIG. 7.



A B, A C, A E, A G, C D, F G, give the relations of curve to median line, A H.

a flesh pencil, and also attach a slight weight to the end of the line, allowing it to hang, the patient standing firmly on both feet. The distance of this line to the right or left from the cleft of the buttock is to be noted, and the amount of deviation, or the fact if it passes directly over it as it normally should. The spines of the vertebræ are to be marked by a skin pencil, and the following points measured and noticed:

1st. The distance from the vertebra prominens to the point where the line of the spine begins to deviate from the central line.

2d. The point where the upper curve (measured in distance from the vertebra prominens) is at greatest variation from the central line, and the amount of that variation.

3d. The distance from the vertebra prominens to the point where the line of the spines again meets the central line.

4th. The distance from the vertebra prominens at the point where the line of the spines is at its greatest distance from the median line in the lower curve, and the amount of this distance.

It is only necessary that the patient should remain in the natural attitude while these points are marked. Measurements can be taken at leisure, thus avoiding the fallacy of a change of the patient's position by fatigue. Some care is needed in marking these points, but no more than is possible from an ordinary observer. The limit of error has been found not to be great. The method, with slight change, can be used also to measure the amount of forward and backward curve, if that is needed. No record, however, of rotation can be satisfactorily made by any measurement test, and it is for this reason that various attempts have been made by means of appliances. After trial with many of these methods the preceding seems to be the simplest, least expensive, and will be found to show but slight inaccuracy. The method, however, is not applicable where the bar does not rest upon a broad, bony space, such as is furnished by the ribs.

A sufficient amount of accuracy is also obtained in a simpler way, by placing a light steel or wooden bar of a given length, such as a rule, across the back at the requisite part, and measuring the distance to the plane of the ends of the rule. The difference of these distances can be taken as a record of rotation, or by a trigonometrical formula the angle can be easily calculated.

It is believed that any two methods here described will furnish sufficiently accurate records for all clinical purposes, and for the investigation of the results of treatment, and yet be within the means of every competent observer.

DISCUSSION.

Dr. John Dane, speaking for Dr. Bradford, in the absence of the latter, stated that photography was at present considered to be the best method of recording cases of lateral curvature, although it undoubtedly had many defects.

Dr. B. E. McKenzie said that the committee was a unit in the position assumed in this matter. He had written to Dr. Bradford, stating that he had given up every method except "honest photography," and had received in reply a letter from Dr. Bradford, stating that he was rejoiced that the committee was a unit and had been sustained in this matter. It was, of course, important that the patient should be so placed that the pelvis was at a right-angle to a forward line through the camera. The same position should be assumed, of course, in the subsequent photographs. If any measurements were to be taken they should include the legs and the pelvis.

Dr. Bernard Roth: As I shall be unable to attend the annual meeting of the American Orthopedic Association, I hope you will kindly allow me to contribute a few criticisms on the paper "Record of Cases of Lateral Curvature," which you have forwarded me. I have given much attention to this subject for the last twenty years, and I am fully alive to the difficulties which beset it.

I will take the paragraphs seriatim:

Paragraphs 1 and 2 are unassailable.

Paragraph 3. The objection to the patient standing is removed when the record can be taken in a few seconds, and this is easily done by the method I have employed for the last fifteen years.

Paragraph 4. Records of the back of the patient in the recumbent position are not satisfactory when there is distortion of the ribs anteriorly, which occurs in most severe cases—*e. g.*, in ordinary **S** lateral curvature, if severe, the left ribs anteriorly are more prominent than the right ribs anteriorly, so that when the patient is lying prone the left half of the thorax will be raised and the right half unduly depressed, so that the proposed measurement by degrees of the osseous deformity (amount of rotation) will be vitiated. In addition to this, the ribs posteriorly are covered by the scapulæ, just where the former are generally most deformed when the patient is lying on his abdomen, and the contour of the loins will vary according as the erectors are contracted or relaxed in the same position.

Paragraph 5. Records of the standing position are useful, provided both the habitual and the best possible attitudes (the latter

indicated by the surgeon) are taken at the same examination, either by photography or other means for recording form.

Paragraph 6. The record in the recumbent position is affected, as already mentioned, by the greater or smaller difference in the contours of the right and left ribs anteriorly.

It is more important to ascertain the difference in the curves in the habitual and in the best possible postures, because this indicates the amount of flexibility or rigidity of the curves, and helps one to a prognosis.

Paragraph 7. All records resolve themselves in ascertaining the absence or presence of rotation, and of the amount of rotation when present.

Paragraphs 8, 9, and 10. I believe the method of recording the amount of osseous deformity when present in a case of lateral curvature, which is given in pages 11 to 20 of the second edition of my book, *The Treatment of Lateral Curvature of the Spine*, 1899 (a copy of which I have sent you), is not open to the severe criticism of paragraph 10. I have repeatedly taken records of the same patient at intervals of days and weeks, and have found the differences insignificant; this has been equally true when medical friends have taken records of the same patient and have compared them with those I had previously taken. I would particularly direct the attention of the members of the Association to Plates I and II in the above-mentioned second edition of my book.

Dr. E. Muirhead Little: I wish to be allowed to congratulate the Association on having taken up the vexed question of records of cases of lateral curvature, or, as I should personally prefer to call it, scoliosis or twisted spine. Having had the advantage of perusing the report of the committee on this subject, I also beg to congratulate its members on the moderation and common sense shown in their conclusions.

Some years ago I made some attempts at the devising of a mechanical apparatus for accurately recording the contour of the back in any given transverse plane. I soon found, however, that to make the machine effective it would have had to be very complicated, and I abandoned the attempt. I have for some time been in the habit of using the methods recommended by the committee, with the ex-

ception of the cross-bar and pendulum, but I have only found them really useful in recording gross deformities. In slighter cases I have found them not delicate or accurate enough to be of use. The cross-bar and pendulum and quadrant seems likely to prove an appliance of considerable value, as it is probably capable of recording a smaller degree of rotation than any other means recommended, and at the same time it enables the result to be expressed in figures. It should be noted, however, that the board or floor on which the patient lies must be horizontal or mistakes will occur. This point is, I think, hardly emphasized enough in the committee's report.

There are, no doubt, many methods by which gross variations may be recorded, but the ideal method must be one which will enable slight changes to be registered. In such cases rotation is often scarcely perceptible in the recumbent position, and only becomes obvious on forward bending of the spine. In this position an accurate use of the cross-bar is impossible.

In rhachitic cases there is sometimes unilateral deformity of the ribs and costal cartilages, resulting in projection of one side, apart from that caused by rotation of the vertebræ. In such a case the cross-bar and pendulum measurements would be misleading, as an absolute gauge of rotation, although it might be valuable as a record of the progress of the case.

As regards the other methods recommended, the following objections, based on some experience, occur to me, and to my mind diminish their ability: It is very difficult to locate the exact position of any spinous process, especially in plump patients. One-quarter of an inch of error is by no means an extreme allowance. This is a great deal, seeing that in a severe case lateral deviation may not exceed one inch.

As to the use of the plumb-line: It often happens that the buttocks project backward further than the vertebra prominens, and the free swing of the plumb is thus hindered, or the parts of the back between the neck and the nates may project and catch the line.

I should like to point out, as a possible source of error, that a gain or loss of fat or muscle will alter the contour of the thorax, and so may falsify the comparison between two records taken at an interval of some weeks or months.

It is with diffidence that I offer these few remarks to the members

of the American Orthopedic Association. I am painfully aware that, while I have stated several objections, I have not been able to offer a solution of the problem, but I trust that the forthcoming meeting will result in the recommendation of some method even more effective than those recommended by the committee.

Dr. Henry Ling Taylor said that the problem was to record the form of an irregular solid—in other words, a body of three dimensions. To his mind this was impossible by any simple means. Some had advocated the taking of an entire cast, but even this was not accurate, for, while the cast was being taken the form would change, the body being not only an irregular solid, but a variable irregular solid. The recommendations of the committee seemed to him open to many of the criticisms that had been read, but were, upon the whole, as practical as could be brought forward at this time. To these he would like to add the measurements of the height of the patient when standing and when sitting. To be sure, most of these patients were in the growing period, but the average rate of growth was pretty accurately known, and if the rate exceeded or fell short of this average it was worth knowing. He would, therefore, recommend that the standing and sitting heights of the patient be recorded under the same conditions at intervals of say three months.

Dr. H. A. Wilson said that, aside from the matter of the personal equation, which was an important factor in taking measurements by any method, there was the question of interpreting the records. He had repeatedly seen records which had to be explained. To a body of specialists these explanations were a simple matter, but to the general profession and to the laity, who desired some idea of the progress made by a given case, the methods with which he was familiar, other than photography, required a great deal of explanation. Hardly any one doubted that radiography was very important, yet even with the radiographs just presented there had been different methods of interpreting with those present. Personally, there seemed to him nothing which would compare with honest photography for accuracy of record, because of the small part played by the personal equation and the ease with which these records could be understood by any one. Moreover, by photography one could

judge whether the posture was an honest or a forced one. He hoped if the Association adopted any one method it would be photography.

Dr. Newton M. Shaffer, of New York, said that lateral curvature was only rotation with the accompanying distortion. His own measurements had been made with this idea in view. A satisfactory solution of this question would not be reached outside of photography until one had algebraic formulæ for expressing the actual amount of rotation present. It seemed to him if the investigation had been confined simply to the element of rotation a more satisfactory conclusion would have been reached. If the rotation were carefully noted at the beginning and end of the treatment the record would be fairly satisfactory. He strongly favored honest photography.

Dr. R. W. Lovett, of Boston, said that the conditions under which the photograph or measurement had been taken should always be considered. For instance, in a case in which the distortion was chiefly muscular, if the patient at one moment assumed a good position and at another sunk into a careless attitude, it would be necessary to take the photograph in conjunction with the statement as to the conditions under which the standing record had been made.

Dr. S. Ketch, of New York, said that it seemed to him decidedly unwise for the Association as a body to indorse any one method with the present divergence of opinion. He was opposed to any official indorsement of a fixed method of recording lateral curvature at the present time.

Dr. Taylor said that he had understood Dr. Wilson to advocate photography because it practically eliminated the personal equation and that the results could be easily interpreted. He would challenge this statement, for, in his opinion, photography was neither free from the results of the personal equation nor from the necessity of skilled interpretation. He thought every practical photographer would bear him out in the statement that in the most innocent manner possible untrustworthy results might be obtained, as for example, from the mode of managing the illumination, the position of the

patient, the mode of printing, etc. He did not mean to imply by this, however, that photography was not a very valuable method of recording lateral curvature.

Dr. Wilson replied that the expression "honest photography," as used by Dr. McKenzie, seemed to him to exclude all such attempts, as by light, position, or otherwise, to produce false results.

Dr. Taylor rejoined that if it were possible to manipulate a photograph intentionally, as admitted by the last speaker, it was also possible to do so unintentionally and innocently, even with the same process and the same operator. In fact, two successive photographs of the same subject were rarely taken under exactly the same conditions.

Dr. Truslow described a quick method of recording that had been adopted at the Hospital for Ruptured and Crippled. With a brilliant light and a record-book having a long page, it was possible to obtain a shadowgraph or simple tracing very quickly indeed. A strip of adhesive plaster was placed on the patient's back, and with a pencil the tip of each spinous process was marked with a dot, and then the strip of plaster was transferred to the record-book. The placing of this strip was, of course, a matter of judgment, and was not absolutely accurate.

Dr. Dane described a new method, somewhat similar to that shown by the last speaker, that he had been using for some time and found very satisfactory. He began by marking the apices of the spinous processes with an oil and lampblack cosmetic pencil. A sheet of blotting-paper, cut some seven inches wide and twenty inches long, was then pressed lightly against the marked back, thus obtaining a tracing of the position and relations of all the processes. A thin form of paper, such as is bound up in letter-files, was the most convenient for use. Several tracings can be taken of a back in different positions, such as sitting, standing, hanging, also leaning to one side; and when these, or tracings taken after an interval of time, are superimposed and examined by transmitted light, a very suggestive and graphic picture is obtained. Additional information

can be shown on these tracings by the use of Dr. Brackett's modification of the Bech measuring-tape. Rapid measures are taken, both in a horizontal and antero-posterior plane, and the results drawn or figured upon the paper.

Dr. Wilson said that the method of Dr. Bradford, in which a level was employed, and the methods of Dr. Davis and others were intended to be used by the surgeon himself. He has never been willing to send a young girl to any lay photographer and have her stripped and photographed. For this reason he had always made it a rule to attend to the photography himself.

Dr. C. E. Young, of Philadelphia, said that he had been using a muslin transfer paper for this purpose, fixing it on the spinal column and marking on it the deviations of the vertebræ. He had also been using a simple machine employed to some extent in Philadelphia.

Dr. G. G. Davis, of Philadelphia, said that by means of a camera obscura or a camera lucida a tracing could be made which would be useful in practice, if not exceedingly accurate. Successive tracings at intervals of fifteen or twenty minutes should give a good result.

Dr. Dane said that he had experimented with this method for several years, but it had proved very disappointing in actual practice.

Dr. Davis replied that one of the first requisites would be illumination of the object by some bright light, such as that from an acetylene-gas lamp. The lenses employed, and also the nature of the background, would have much to do with the facility of making these tracings.

NEW APPARATUS.

A BRACE FOR THE TREATMENT OF STIFFNESS OF THE ELBOW.

By GWILYM G. DAVIS, M.D.,
PHILADELPHIA.

In certain cases of stiffness and limitation of movement at the elbow the necessity is felt for some form of appliance by means of which the joint can be fixed at various angles, its position varied, or stretched in the desired direction.

The splint of Strohmeyer has been the apparatus most commonly used for this purpose. It consists of two pieces, one for the forearm and the other for the arm, hinged opposite the elbow-joint. The joint is then flexed by means of a turn-buckle or screw passing from the arm to the forearm-piece.

This mechanism is satisfactory within certain limits. Its range of motion extends from a straight line to nearly or quite a right angle. In other words, by it we can get normal extension of the elbow, but not normal flexion.

The object of the apparatus here described is to get a greater extent of movement, so as not only to be able to fully extend the arm, but also to flex it to much less than a right angle, to about 60 degrees. This object is accomplished first by using a peculiar turn-buckle. It is one which has been used by the D. W. Kolbe Company, instrument makers, of Philadelphia, for twenty-five years or more, and it deserves to be better known than it apparently is. It consists, as does the ordinary turn-buckle, of three pieces. It differs, however, in having one screw large and the other small in diameter. The large screw is hollow, and as the middle piece is turned the two

screws approach each other, and finally the smaller screw telescopes in the larger one. By means of this arrangement the middle piece of the turn-buckle can be reduced to nearly one-half the usual length and still have the same amount of action. This reduction in size enables the forearm to be brought closer down to the arm. To aid in accomplishing this object, one end of the turn-buckle is by means of a thumb-screw made movable, so as to be changed at will from the

lower to the upper arm band; the lower end can also be set by means of another thumb-screw at any desired distance on a flat bar which runs from one forearm band to the other.

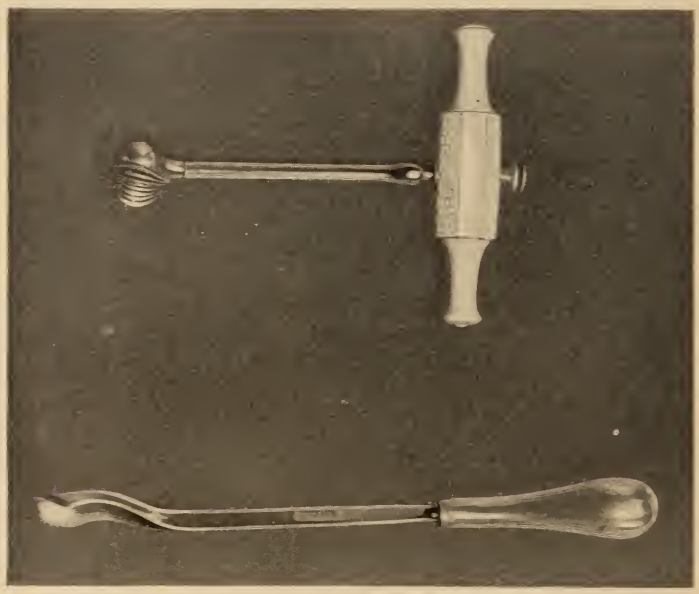
If extreme flexion is desired the turn-buckle is set high up on the arm and far out on the forearm. If, on the contrary, extension is desired the turn-buckle is fastened low down on the arm and nearer to the elbow on the forearm. This adjustment can be readily made by the patient himself.

INSTRUMENTS FOR THE FORMATION OF A NEW ACETABULUM IN CONGENITAL LUXATION OF THE HIP.

By GWILYM G. DAVIS, M.D.,
PHILADELPHIA.

In operating for congenital luxation of the hip I have experienced some difficulties in making a proper acetabulum, or rather a new socket for the head of the femur. The instruments at my disposal were Volkmann's sharp spoons or curettes, Hoffa's bayonet-shaped curette and ordinary straight gouges. With these I found I was not able to form the socket either as expeditiously nor as accurately as was desired. I have not seen the curettes of Lorenz. To nicely hollow out a hemispherical cavity, with a prominent overhanging upper edge in the depths of the wound, is, from a mechanical standpoint, no easy task; this is particularly the case when using the ordinary gouge and curette. They lack the proper shape for such a purpose. This led me to devise the following instruments, which admirably accomplished the purpose: one is a gouge and the other a burr. The gouge is practically such a one as is used by wood-carvers. It consists of a bowl-shaped blade with a sharp, rounded edge, which is strongly bevelled on its outer surface. In using it the fibrous, cartilaginous, and bony tissues can, on account of its sharpness, be cut away with ease and remain in the hollow of the blade, and are withdrawn when it is removed from the wound. The sharp bevel causes it to cut its way out almost as soon as entered, and its shape is such as to allow any desired spot to be reached. After the cavity is approximately of the shape and in the location desired the burr or second instrument is to be used. This consists of a rose burr about 25 mm. (one inch) in diameter and about 15 mm. thick. One-half of the circumference of the burr has ten cutting edges, while the other half is perfectly smooth. It is attached to a short

shaft and handle, such as are used on trephines. When this burr is introduced into the wound the inequalities of the new socket are quickly smoothed off, and can even be deepened at points and the upper edge undercut if thought necessary. While this is being done the smooth part of the burr is opposite to the displaced head of

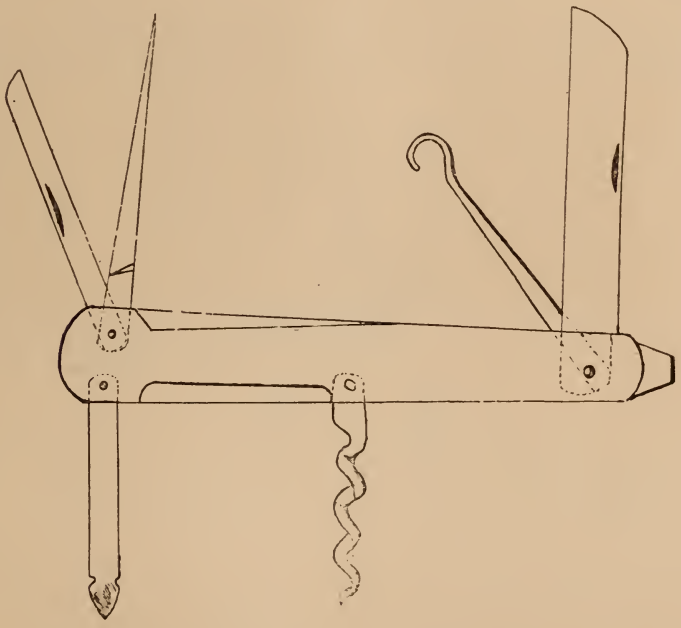


the femur, and thus the latter is protected from injury. The use of these instruments will, I think, facilitate the making of that prominent and projecting upper edge which is so important to prevent recurrences. They are made by the D. W. Kolbe Company, surgical instrument makers, of Philadelphia.

AN ORTHOPEDIC KNIFE.

By STEWART L. McCURDY, M.D.,
PITTSBURG.

An orthopedic knife illustrated below contains, first, screw-driver projecting from the small end of the handle; second, nail tool; third, reamer, which may be used for the purpose of perforating

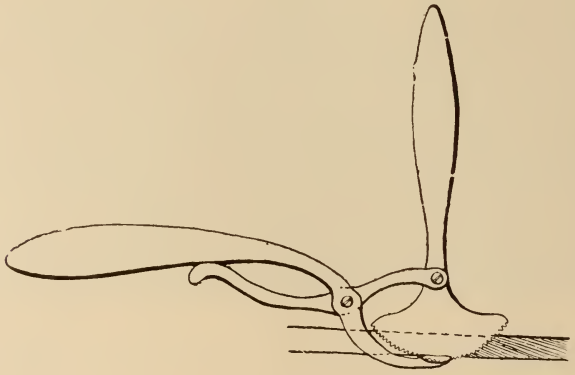


leather, plaster-of-Paris, or enlarging holes in the metal; fourth, button-hook; fifth, cork-screw; and sixth, two plaster-of-Paris blades, with the cutting-edge straight to the point.

PLASTER-OF-PARIS SAW.

By STEWART L. McCURDY, M.D.,
PITTSBURG.

Below is an illustration of a saw for use in removing plaster-of-Paris bandages. As can be seen, the handle is continuous with the portion which goes underneath the plaster-of-Paris, and that the



saw is on a lever, which may be forced down on the plaster as desired by pressing upward on its distal end underneath the handle. The cut is made by moving the saw-handle backward and forward.

HEAD-SUPPORT FOR CERVICAL CARIES.

By STEWART L. McCURDY, M.D.,
PITTSBURG.

Herewith is presented a head-rest (Fig. 1) for the treatment of disease of the cervical vertebræ, to be used as a substitute for the Thomas and other collars. As may be seen, it is composed of a wire frame consisting of two parts, one in front extending from the mandible to the sternum, the wire being bent from these two points backward around both sides of the neck. The posterior portion makes pressure upon the occiput above and the vertebræ prominens

Fig. 1.

below. From these two points the wire frame extends forward on both sides of the neck to near the wires from the anterior segment. On one side these two segments are hinged, and on the other side they are held together by a clasp. Being made of wire it is more airy, and can be bent so as to be adjusted to the case as may be necessary. With this apparatus pressure is made upon bony points in such a way as to perfectly equalize the support and lift the weight of the head from the diseased vertebræ.

Ever since I began the practice of orthopedic surgery, the one constantly used apparatus which appeared to be the most objectionable, because of its unsightliness, is the jury-mast. Several different varieties of substitutes have been used, but not with perfect satisfaction. Another objection to the jury-mast is that it furnishes a support from the pelvis through a circle rather than in a straight line from the supporting point to the part to be supported. Attention is called to this illustration (Fig. 2) not because it is a new idea, but rather to emphasize the importance of a change in the method

FIG. 2.

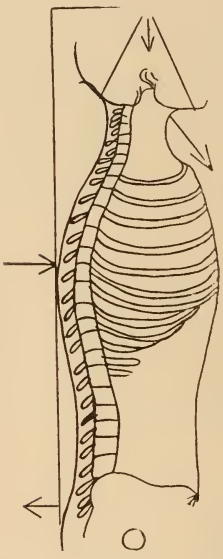
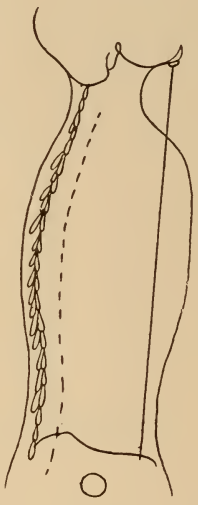


FIG. 3.



of treatment. Fig. 3 shows the proper line of support—viz., from the anterior superior spine to the mandible, and not as shown in Fig. 2, from the sacrum along the spinous processes up and around the back of the head to the chin and occiput. To carry out this idea, the apparatus shown in Fig. 4 is now in constant use for all these cases. To prevent the chin from sliding forward it may become necessary to make the chin-piece cup-shaped, to prevent the head from sliding forward. It is my practice never to leave the jacket on, but instead it is cut off and finished as shown in Fig. 4. The head-support is held to the jacket with screws secured in the upper

end of pieces of metal worked in the jacket, which extend to the anterior superior spines. The posterior occipital support is secured to

FIG. 4.

the back of the jacket in a similar manner. It has not been found necessary to use a jury-mast in six years.

KNEE BRACE FOR CORRECTING DEFORMITY.

By WILLIAM E. WIRT, M.D.,
CLEVELAND, OHIO.

All surgeons who have had much experience in the treatment of joint-diseases agree that the first indication for treatment in a case of tubercular ostitis of the knee is usually that of correcting the deformity which, in a large percentage of the cases, exists before much treatment is begun. In many cases this correction of deformity is a difficult task; especially is this so if the deformity is of long standing and the spasm of muscles is considerable. One of the difficulties to be encountered is the backward displacement of the tibia upon the femur, which takes place during the process of correcting the deformity. This is generally conceded to be due to the backward pull of the contracted hamstring muscles, which, holding the head of the tibia in check during the process of extension, brings about a partial dislocation of the tibia backward.

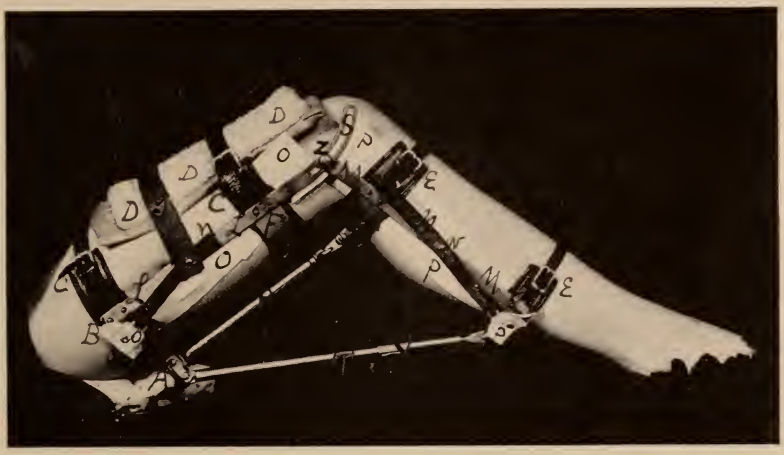
Many braces have been devised for the correction of knee-joint deformity, some taking into account this tendency to partial dislocation in the knee-joint, but more of them entirely ignoring it.

Dr. Newton M. Shaffer, of New York, has devised a well-known brace for this purpose, which is especially arranged to push forward the head of the tibia, and to bring about traction upon that bone. But the brace is somewhat intricate in its design, would require a skilled instrument-maker to manufacture it, and the cost is such as to place it without the reach of many patients.

I desire to present to this Society a brace for the correction of flexion deformity at the knee which, beside correcting the flexion, will overcome the backward displacement, and at the same time will produce traction on the tibia—a brace simpler in design than the one previously referred to—one that is not difficult to make, and the cost of manufacture is less than half the listed price of the Shaffer brace.

I have been using the brace for some three or four years, and have not presented it to this Society heretofore, because I was not sure but that others were using similar braces; but finding no description of any brace particularly like it in the literature of this Society, or in recent works on orthopedic surgery, I take the liberty of presenting the brace for your consideration.

The brace I am describing has a thigh-band, a knee-band, a calf-band, and an ankle-band, all of which bands are about half the circumference of the parts they encircle, and their circumferences are completed by leather straps. Side bars on each side of the thigh, connecting the thigh and knee-band, are extended four to six inches



below the knee-band, with a slight curve forward, and are slotted for two or three inches of their lower ends. The calf and ankle-bands are connected in a similar manner to the upper bands, and the up ends of these side bars pivot into the slot of the upper side bars. This permits the point of action at the knee to be a movable one, to correspond with the movable axis in the knee-joint. Extending from the thigh-band nearly to the calf-band is a hollow cylinder into which fits a rod upon which is a screw thread. Upon the rod is a nut which on being turned forces the calf-band, or, better, the upper part of the lower half of the brace, forward. This causes the pivot of the brace to move downward and forward along the before-described slots. From the thigh-band to the ankle-band

is another hollow cylinder into which screws a threaded rod. The brace is fixed to the thigh and leg by means of adhesive plasters which are placed on each side of the limb, the ends with buckles in them being turned back over the thigh- and ankle-bands, and secured to the brace by straps fitting over brass heads or buttons. By this means, when the ends of the brace are separated (other than by extension), traction is made on the tibia.

In using the brace I have found that the greatest point of pressure is on the anterior surface of the thigh just above the knee. It is desirable that at this point the pressure should be spread as much as possible. This can be admirably done by the use of pads made from a wood which grows in New Mexico, samples of which I here present. This wood is especially adapted for this purpose, and I have seen no other wood like it. It is perfectly flexible one way, and can be wrapped perfectly around a limb, while in the longitudinal direction it is fairly unyielding. A splint of this kind, well covered and with plenty of padding underneath it, can be made to transmit the pressure to the whole front of the thigh.

The brace being applied with numerous pressure-pads made in the manner described, extension of the leg is made by turning the cylinder passing from the thigh to the ankle-band. The head of the tibia is forced forward by turning the nut on the rod at the calf-band. As the rod from the calf-band simply slides into the cylinder from the thigh-band there is nothing to prevent the calf-band from moving forward without turning the nut (in the general plan of extending the leg by the lower cylindrical rod), but when the calf-band is pushed forward by the upper rod the lower cylinder, if not turned, will hold the calf-band fixed, otherwise the action of the calf-band and upper rod would be to simply extend the leg instead of pushing the head of the tibia forward as is desired.

When the leg is flexed at right angles upon the thigh the pull of the hamstring muscles is simply backward, and does not, therefore, force the bones together; therefore, traction at this point is not required, but when the limb is nearly in a straight line the action of the muscles are largely to pull the ends of the bones together, thus increasing the irritation. It is then that the separation of the two parts of the brace, or the change of the axis of motion permitted by the slot in the brace, brings about the greatest traction. In other

words, the greatest traction produced by the brace is at that point where the greatest traction is required.

In one case where the joint was very sensitive I supplemented the brace by means of the weight and pulley, and I found that they can be used together with perfect ease.

In the cut the parts of the brace are as follows: At A are pins for pivoting the calf (R) and ankle (T) band extension cylinders. B is the thigh-band, F the knee-band, H the calf-band, and K the ankle-band. D D D are the pressure pads over the knee, O O O and P P P are the adhesive strips, L L are the side bars for the thigh portion, and M M the side bars for the leg portion of the brace. Z is the axis of the brace, and S is the slot which permits the axis to be a movable one.

DISCUSSION.

DR. SHERMAN asked what kind of fragments were obtained from the rose-burr and what became of the sawdust made by the instrument?

DR. DAVIS replied that the dust made by the instrument must be removed from the wound by irrigation.

DR. SHERMAN said that the ordinary metallic mallet was objectionable for osteotomy, and the old rawhide mallet would uncurl on boiling. He had found that the ordinary "potato masher" was an absolutely perfect mallet for this purpose, the side of the masher being used to strike with.

He would be afraid that the cervical support exhibited by Dr. McCurdy would allow of an objectionable amount of lateral play.

DR. WEIGEL said that by levers on the side arm it was easy to construct an apparatus which would give any desired amount of flexion and extension at the elbow without a complicated mechanism. This principle he had long employed, and had always found it useful.

DR. DAVIS, in reply, said that he could not see any advantage in having two lateral mechanisms where one median device would do.

He had not presented the foot-brace as a novelty, but simply to direct attention to the pattern, and particularly to the manner of shaping the side bar around the ankle.

Dr. McCurdy said that the model presented to him was a very crude one, but he did not think it would allow of an objectionable amount of lateral motion of the head.

THE KYPHOTONE, OR MODIFIED PLASTER-JACKET STOOL, FOR THE CORRECTION OF HUMPBACK.

By R. TUNSTALL TAYLOR, M.D.,
BALTIMORE.

In the latter part of 1894 I presented before the Johns Hopkins Medical Society what I termed an apparatus for applying plaster jackets, or the plaster-jacket stool. The report of this machine subsequently appeared in the *Johns Hopkins Bulletin*, No. 45, February, 1895, and in the *Medical News*, March 23d, of the same year.

In that paper, as far as I can find out in the literature, I first called attention to the importance of extending the spine backward in applying jackets and the maintenance of this position for the prevention or correction of the natural tendency of the deformity of Pott's disease—*i. e.*, the falling downward (flexion) of the upper segment of the spine and the contraction of the thorax.

For those not familiar with the apparatus, I will state that the original machine consisted of an office-stool surmounted by a bicycle-saddle, and the top of the stool was so cut out on the sides to allow the legs to go rather vertically down. The legs were fully extended and the feet were fastened on rigid adjustable stirrups. To make the pelvis more thoroughly fixed, I took several turns of a wide webbing strap around the lower part of the pelvis and hips, the bicycle-saddle, and the top of the stool. Arising from the lower posterior part of the stool was a steel rod extending up as a T-piece some feet above the patient's head. By means of a hinge at the bottom this rod could be moved through an antero-posterior arc and set by a pin and slot. Dependent from the T-piece were rigid handles and rods, adjustable for different lengths of arms and width of shoulders. A Sayre head-sling completed the apparatus attached to the centre of the T-piece.

The patient was placed on the saddle, the legs and pelvis were

made as secure as possible, the arms were extended upward and backward as far as possible to the handles—the head-sling adjusted and traction made. Then the upright rod was carried backward, and forced extension made with the ribs well raised and thorax deepened through the traction on the pectoral muscles—lordosis was produced. In this position the jacket was applied. Among the advantages that I claimed for this apparatus were:

1. The jacket thus applied fixes the spine in the most advantageous position for lessening the tendency for the production of deformity. When a plaster jacket is indicated for any reason in preference to a steel back-brace, this method I have found the most efficient in applying it.

2. The rapidity and ease with which a jacket may be applied, an advantage of no small moment in a crowded out-patient plaster-room.

These jackets require, as a rule, no trimming at the crease of the groin in front or in the axillæ, notwithstanding the fact that they are carried well down on the pelvis and high up on the sternum to the interclavicular notch. (The surgeon applies the jacket facing the patient.)

3. It seems applicable to mid-dorsal and lower-dorsal and lumbar caries.

4. It seems comfortable to the patient, as the thorax is well supported and the superincumbent weight is removed from the diseased vertebral bodies to the healthy articular processes and hips.

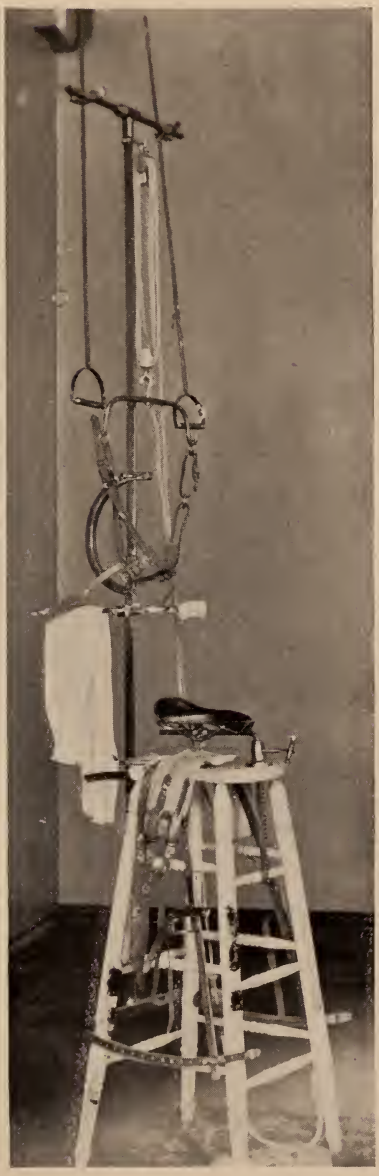
5. It is not an expensive apparatus.

I would now add as advantages over other methods the absolute immobilization of the patient in the desired corrected position: One person being able to apply the method without assistants to steady the patient; nothing can slip at the most important moment.

This apparatus, without modification, was in constant use in the out-patient department of the Hospital for Crippled and Deformed Children on nearly all suitable cases from 1895 to the middle of last year, when the modifications to be described were added.

The criticism made of the original plaster-jacket stool was that in a severe case with marked gibbosity the deformity would be apparently increased by the increased compensatory lumbar lordosis, as there was nothing to regulate at what point the backward bending should occur.

FIG. 1.



The kyphotone.

Accordingly, when our interest was aroused by the work of Calot, Chipault, Tubby, Robert Jones and others in the forcible correction of the deformity of Pott's disease by extreme traction, which was so generally tried, and Goldthwait's excellent method of extension, I had made a rod and small pressure plate, which could be adjusted, to push forward on the gibbosity from the posterior upright, and thus tend to make the kyphos the centre of the arc of lordosis, as is desired. Just above this rod I have also added a joint permitting antero-posterior motion and fixation, a means by which the handle-rods may be adjusted by a spring instead of thumb-screws, and the top of the T-piece can rotate when the upright is drawn back to avoid sudden jerking on the arms.

In ankylosed spines we do not use great force, simply rendering them as straight as possible *short of pain;* but in early cases and in those in which the deformity is increasing it has proved an instrument of precision in a large number of cases. We have called it the kyphotone (*Κυφός*, hunchback, and *Τείνειν*, to extend), being shorter than the old term.

The technique of this method is as follows: The patient is placed on the saddle and the legs and hips made fast, as previously described; the portion of the spine below the deformity is then made perpendicular to the floor by means of the pressure-rod placed an inch above the apex of the kyphos; then the head-sling is put on, and as much traction is made as the patient can tolerate, the hands being fully extended upward and backward on the handle-rods. That portion of the upright which is above the pressure-rod is carried back to any angle it is desired to make traction before actual extension is applied. In this extended position the jacket is applied. As soon as traction is made on the head-sling the padded pressure-plate comes over or just below the apex of the kyphos. Our results have been gratifying, not only in the lessening or obliteration of the deformity, but in the improvement of the general health and nutrition from increased lung expansion, and the clearing up of paraplegic symptoms, the latter as seen in other methods of forcible correction of humpback. The photographs show the method and some few of the cases, but I will not go into details about them—suffice it to say that we use this apparatus habitually in all of our favorable cases, and have done so with satisfaction. I have not attempted the use

FIG. 2.

A patient (J. K.) on the kyphotone before reduction.

FIG. 3.

A patient (J. K.) on the kyphotone during the reduction of the kyphos.

of anæsthesia with this method, but rather avoided it. If desired the kyphotone could be tipped backward and rested on a table

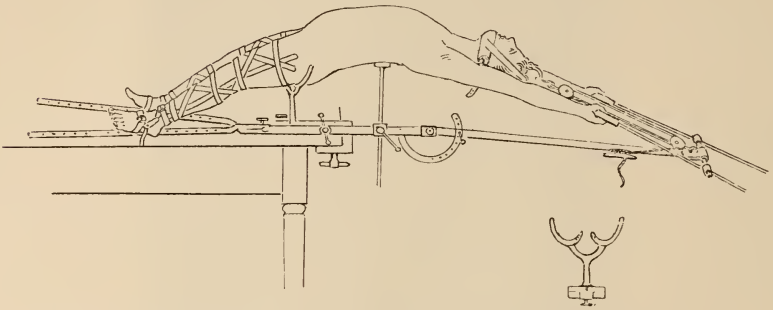
FIG. 4.

A patient (J. K.) showing the result of reduction and "summer jacket."

or some similar support to use ether, if deemed expedient to use sufficient force in any case to warrant it.

I am having made a recumbent kyphotone, as shown in the drawing, for use in cases of such acuteness that the recumbent posture would be safer than even momentarily sitting the patient up until the head-sling is put on and the superincumbent weight removed.

FIG. 5.



The recumbent kyphotone attached to a table. The ischiatic crutch.

A SUMMER PLASTER-OF-PARIS JACKET FOR POTT'S DISEASE.

By R. TUNSTALL TAYLOR, M.D.,

AND

SMITH HOLLINS McKIM, M.D,
BALTIMORE.

When we come to examine the mechanics of the treatment of Pott's disease we find three points of pressure are necessary to prevent or overcome the tendency of the disease to produce deformity. These points of pressure should be mechanically united, and should consist of the sternum and iliac spines in front and the kyphos in the back.

Probably every one has noticed in some plaster jackets that the first point to soften after they are worn some time is over the abdomen, due to the respiratory movements of the abdominal wall, and it occurred to us, why not leave as much plaster bandage as possible off of the abdomen, as it affords no osseous support, and in our southern climate would make the jacket cooler? Then, if the segment of the column above the kyphos is held well back by pressure against the sternum through the ribs (which are raised by raising the arms upward and backward), it is unnecessary to carry the plaster bandages more than an inch or so above the kyphos, thus using still less of a jacket and adding to the coolness. Our results by this method have been just as satisfactory as where a whole jacket is used, but, of course, it is not applicable above disease in the sixth dorsal vertebra. This method, so far as we know, can only be used in conjunction with the kyphotone, with the pressure-rod for lessening the deformity.

It will thus be seen that these jackets are virtually a figure-of-

FIG. 1.

A patient (F. Q.) with paraplegic symptoms before reduction of the kyphos.

FIG. 2.

Summer plaster jacket on patient (F. Q.), showing reduction of deformity and no paraplegia. Abdomen unusually prominent (through the "window"), as the child had been crying.

eight plaster bandage; starting at the sternum they are carried backward and downward over the corrected gibbosity, thence forward around the ilia, and in the reverse order to the starting-point, recrossing in the back where small straps of zinc can be moulded with the hand and incorporated in the jacket to strengthen it.

The photographs give a good idea of the appearance of these jackets.

SOME NEW TRACTION APPARATUS FOR HIP DISEASE, POTT'S DISEASE, Etc.

By R. TUNSTALL TAYLOR, M.D.,
BALTIMORE.

Inclined Plane.

It is a recognized principle among orthopedic surgeons that in the acute stages of hip-disease traction must be made in the line of the deformity, and to meet this requisite various inclined planes of wood have been devised. Unfortunately, hip cases are not exempt from the exanthemata of childhood, and should a wooden inclined plane be used in any infectious case, nothing remains for the safety of future cases but burning the wooden apparatus, a costly means of safety. Notwithstanding the most scrupulous care on the part of the nurses, vermin may be introduced into a bed by the patient or friends of a patient, and the wooden inclined planes and their pads furnish favorable hiding and breeding places.

I have, therefore, had made a skeleton steel frame, nickel-plated, which can be steam-sterilized in such contingencies, which resemble two small Bradford frames with one common end. On the uppermost frame, which supports the leg, can be laced a frame-cover of twill-cotton that should extend from the gluteal fold to a point corresponding with the malleoli of the patient, thus removing all pressure from the heel, which at times with the older apparatus becomes sore. The uppermost frame has a series of holes in its distal end, into any of which a steel wire arch can be inserted, to prevent the pressure of the bedclothes on the toes.

The uppermost frame moves on the lower one at their common end (the proximal end) as a hinge, and can be adjusted at any desired angle of the position of the flexion by means of an inverted $\perp$, the arms of which slide on the sides of the lower frame, and the

upright is attached to the centre of the distal end of the uppermost frame. A chain is fastened to the junction of the arms and upright of the T, and by means of a pin in the centre of the distal end of the lower frame and this chain the angle can be set.

FIG. 1.

The inclined plane and traction apparatus applied in coxalgia.

The lower frame differs from the upper in not being quadrilateral, but rather like a skeleton T, to give a broader base of support. Any position of adduction or abduction can be regulated by simply turning the end of the apparatus in or out as the case requires.

NEW TRACTION PULLEYS, RODS, AND SUPPORTERS.

The same may be said in regard to cleanliness of the old wooden traction apparatus for hospital beds with adjustable pulleys. I have had made quadrilateral steel frames to hook on the head or foot of the beds above and below as required. This portion is enamelled white. Through the centre of the top and bottom of the quadri-

lateral portion are holes to receive a single nickel-plated steel rod, carrying an adjustable nickel-plated pulley, and the rod is of sufficient height to make traction up to an angle of sixty or more degrees, or the pulley can also be set to make traction on the plane of the

Fig. 2.

Traction rods, etc., used in Pott's disease.

upper surface of the mattress by means of a thumb-screw. This last position is especially useful in the acute stages of Pott's disease.

New Method of Fastening Children on Bradford Bed-frames.

The military cross-straps that are ordinarily used are liable to slip or be unbuckled by restless children, and thus do away with the fixation desired. To avoid this I have had made a short apron of twill-cotton, such as is used for the Taylor back brace, with buttonholes at the neck and axilla. Buttonholes are worked in corresponding positions in the frame-covers, and webbing straps and buckles passing through these fasten the child's shoulders securely down. A similar arrangement is made at the pelvis, consisting of a straight

band with buttonholes at either end, through which webbing straps can pass to fasten the child to the frame. While all of this equipment is a little more trouble to secure and slightly more expensive,

Fig. 3

New method of fixation of patients on Bradford bed-frames.

we are sure of an apparatus that meets the requirements, and we have a permanent investment.

The photographs show well the apparatus above described.

CELLULOID JACKETS FOR SPINAL CARIES.

Dr. Augustus Thorndike said that the first celluloid bandages made according to the method described by him last year had been good, but the subsequent ones had failed, because the different layers had failed to adhere to one another. Dr. Bradford had made good jackets by immersing sheets of celluloid, but the process was long and tedious.

DISCUSSION.

Dr. Sherman said that he had seen the application of celluloid jackets in Vienna, and it had seemed exceedingly easy. They had immersed the sheets of celluloid in what he had supposed at the time to be boiling water. Coming out of this quite limp the sheets were fitted on a mould. Around this bandages were applied, and the whole mould was immersed for a few minutes, after which it had been allowed to cool. He had been much pleased with these jackets, and had gone home very enthusiastic about them. He had tried to copy them and had failed, and had then tried all the variations he could think of, using the original material and also some he had sent out from Vienna; but they had all failed. He had had a little better success with alcohol to soften the celluloid, but it made the cost too great.

Dr. W. R. Townsend said that they had had the same experience at the Hospital for Ruptured and Crippled. The house surgeon had made two jackets—the first one an excellent one, and the second fair; after that they could not do anything with it.

Dr. R. H. Sayre said that he had a beautiful celluloid jacket in his possession, but it was so insufferably hot that the patient could not wear it. The way to make them was to use one large sheet. If dipped into acetone the outer parts only of the celluloid were affected, and that so much as to be entirely dissolved; it was far better, there-

fore, to expose the sheet to the vapor of acetone, but if the exposure were too long the whole sheet would be destroyed. He employed a shallow box, about two inches high, forty inches long, and forty inches wide, which would accommodate a large sheet of celluloid. In the middle of this box was a wire tray, to support the celluloid sheets, and underneath this were placed some sheets of blotting-paper soaked in acetone. After remaining in the box for three or four hours the sheets would be softened, but more or less puckered up. They were then stretched around the model and fastened there with a rubber or ordinary bandage. He had tried the plan of punching the corset full of holes, in order to make it more comfortable; but still the patient complained bitterly of it.

The remarks made about a summer jacket recalled to his mind the fact that one of his father's patients had become quite stout while wearing the plaster jacket, and had himself cut out a large window in front.

Dr. Ridlon said that Hoadley's jacket was made with a figure-of-eight turn of the bandage, but the abdomen was not open—the back was simply left open above the knuckle. The idea was that the patient would bend himself backward at the point above the kyphos, on the same principle that the original Taylor brace had a hinge to allow the backward, but not the forward, motion.

Dr. Goldthwait said that the same thing could be accomplished by cutting out a large window in front, but this had been found not to add materially to the comfort of the patient.

Dr. Weigel objected to leaving the abdominal wall unprotected in front. He said that experimental research had demonstrated conclusively that the abdominal wall and the intra-abdominal as well as the intrathoracic contents had an important function in maintaining the spine in proper position.

Dr. E. G. Brackett said that there were two distinct methods of using celluloid. The German plan was quick and apparently practical, and consisted in taking a paste made by dissolving celluloid in acetone and smearing it on the bandages. These jackets were serviceable and strong, but not beautiful in appearance. The

celluloid itself might also be used according to one of two methods—viz., that of Thorndike, in which celluloid bandages were exposed to the vapor of acetone, and that in which strips of celluloid were employed. This made a very pretty and serviceable jacket. He had been unable to find out from celluloid manufacturers the secret of the successful manipulation of the material. The strips of celluloid should be immersed in acetone and allowed to remain there until they began to pucker. If they were then applied to the mould and smoothed down they would make a good jacket. After the first layer cloth could be added, to give extra strength, and the outer layer might be made of pure celluloid, so as to give a nice finish. His experience was that if the celluloid were taken off the mould inside of two or three weeks it would surely curl and the jacket be ruined. The length of time required to finish the jackets was one of the chief objections.

Dr. R. Tunstall Taylor said in reply to Dr. Goldthwait that his experience had been that if a diamond-shaped window were cut out over the abdomen in a plaster jacket and a figure-of-eight turn were *not* made the weakest points of the jacket would be at the posterior apices of the diamond, and there might be a tendency for the two extreme angles in front to come together, which would defeat the aim of treatment. He had found the figure-of-eight turn essential and the strips of zinc most helpful for durability.

In regard to the suggestion of Dr. Weigel, that the abdominal wall was weakened very materially by leaving this opening, he would say that his impression had been that the objection to the use of jackets in lateral curvature was that they weakened the muscles by pressure and immobilization. So in Pott's disease it would be but fair to apply the same reasoning. This pressure must be quite marked in the solid jacket, if we can judge by the protrusion through the opening in the summer jacket, where the pressure is removed.

Dr. W. O. Plimpton exhibited for Dr. Phelps some new apparatus, as follows: 1. A perineal crutch designed for cases, for example, of cured hip-joint disease where it was desired to take off the

blow produced by walking. 2. A modification of Dr. Whitman's brace, with a long lateral spring, for drop-toe. 3. Brace for cases of hip-joint disease or Pott's disease, in which the spinal brace was attached to a fixed point on the leg. 4. Knee-joint brace with ischiatic ring. 5. Hessing's modification of Potalli's. 6. Phelps' modification of same. 7. Apparatus for wrist-drop. 8. Aluminium corset. 9. Modification of the Grattan osteoclast. 10. A club-foot machine.

DISCUSSION.

Dr. Ketch said that from a casual inspection of the combined brace for Pott's and hip-disease he was led to think that there was a lateral motion of the whole apparatus in spite of what was claimed for it. He had used in such cases the ordinary long hip-splint and the modified Taylor spinal brace quite independently of each other, and considered this an advantage because either one could be removed without disturbing the other.

Dr. G. G. Davis said that he had used this principle of a spring for the drop-toe contrivance, and had found that the spring broke too easily. In the apparatus exhibited there was a stop to limit the motion in each direction, and this probably prevented breakage.

Dr. Plimpton said that if the spring in the drop-toe apparatus were made sufficiently long it should not break easily.

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